

Drought Update

September 2005 WATF Meeting

Roger A. Pielke, Sr.
Colorado Climate Center

presented at the Water Availability Task Force meeting,
Division of Wildlife, Denver, CO, September 14, 2005

Prepared by Odie Bliss

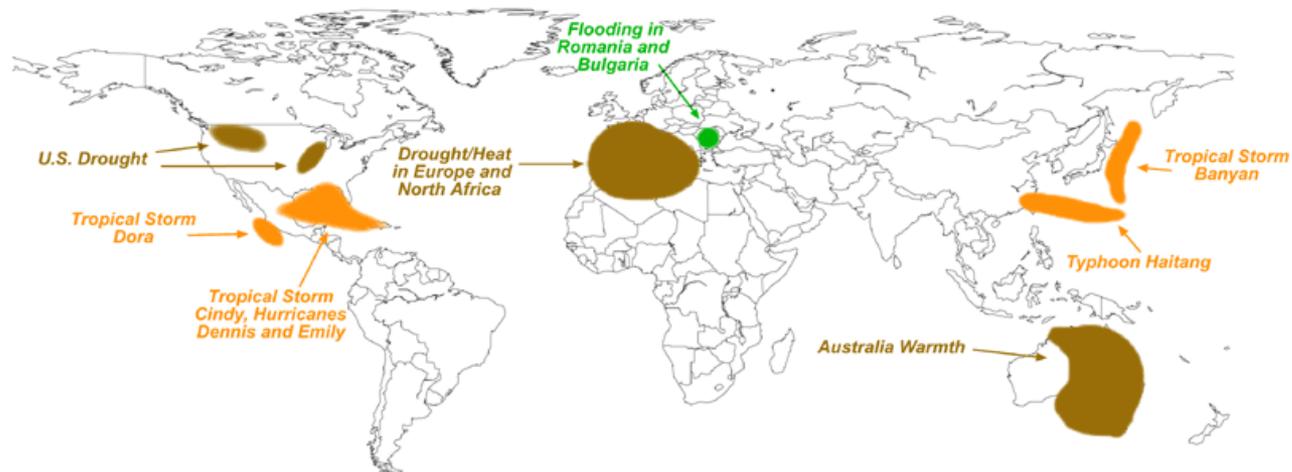
<http://ccc.atmos.colostate.edu>



July 2005



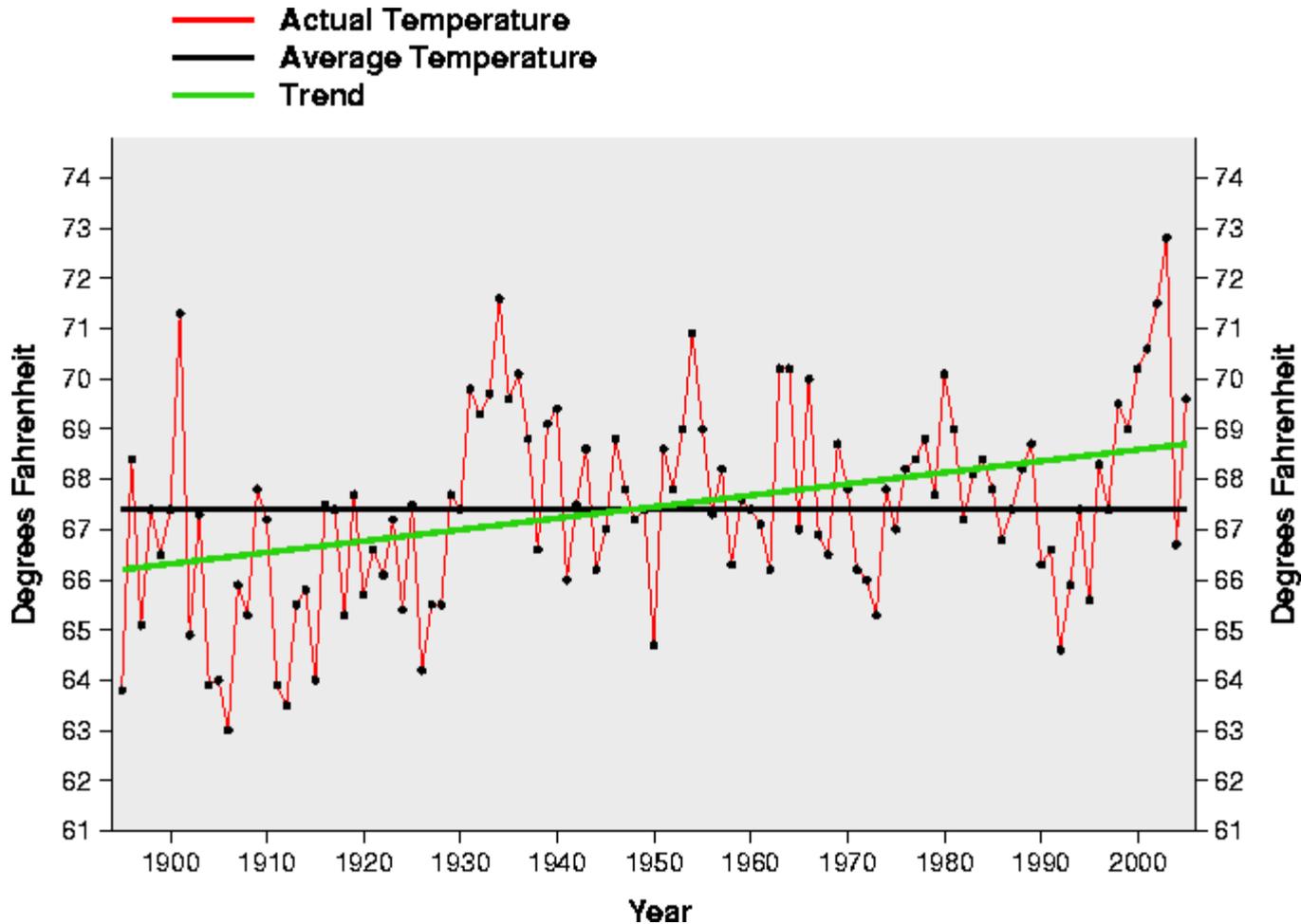
Selected Global Significant Events July 2005



Click On A Shaded Area For More Information

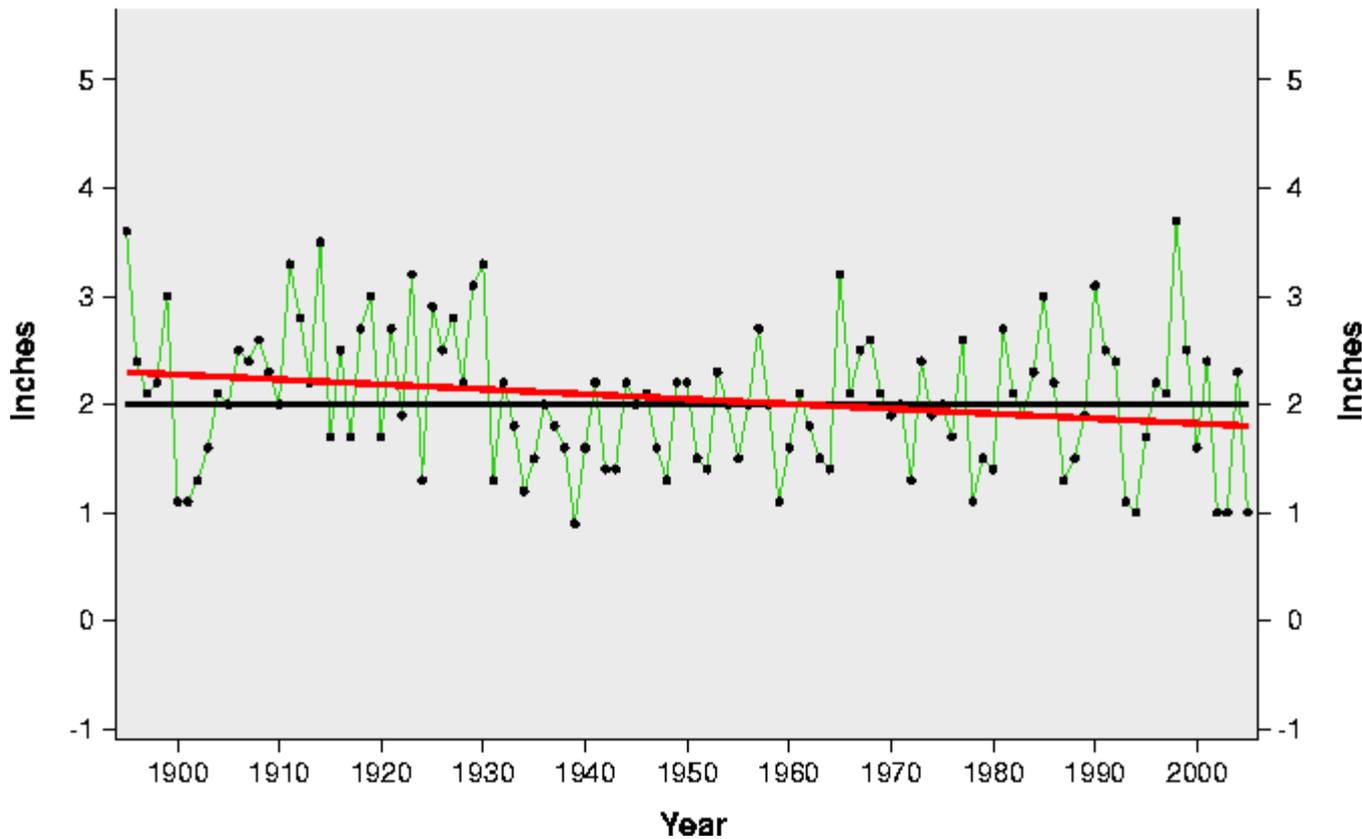


Colorado Average Temperatures

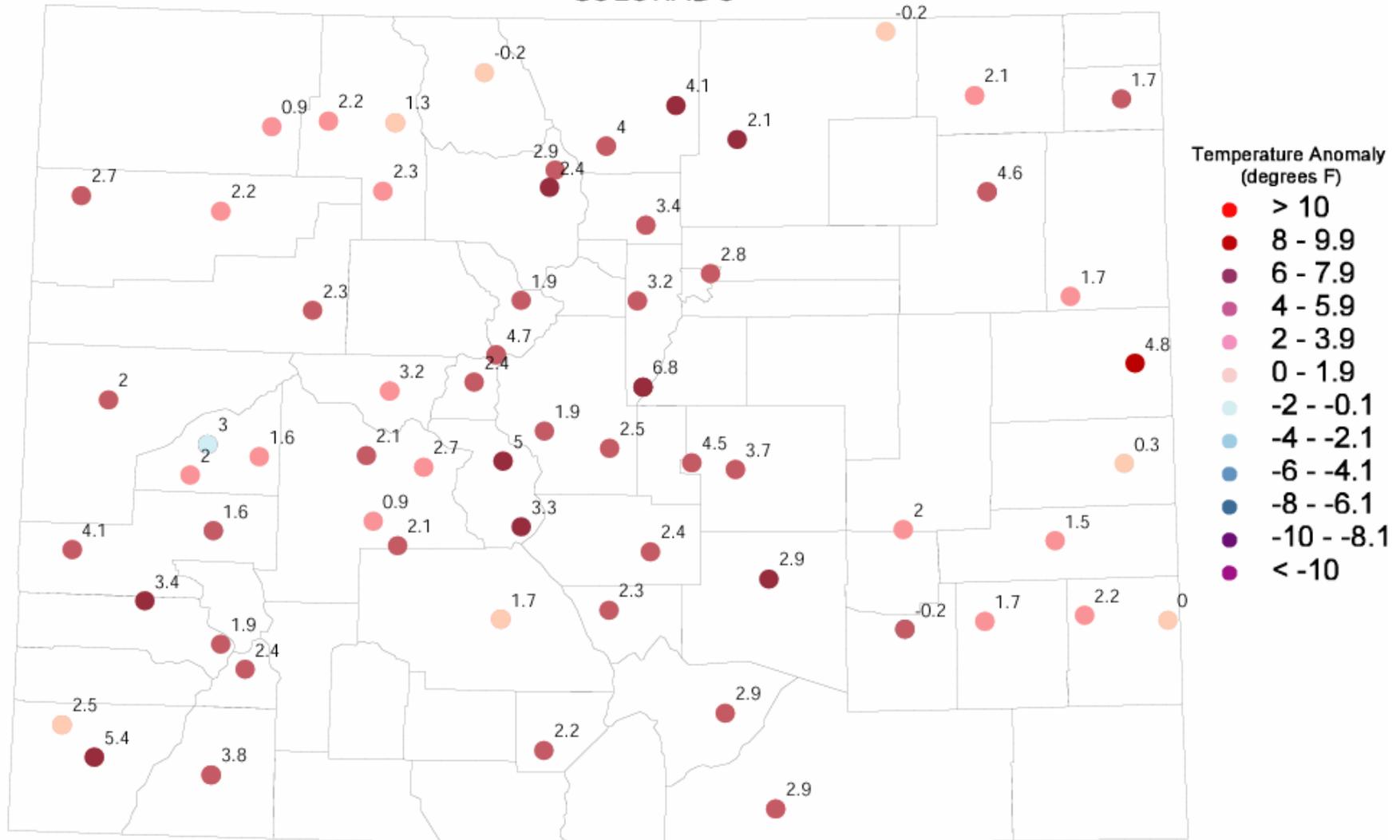


Colorado Total Precipitation

- Actual Precipitation
- Average Precipitation
- Trend

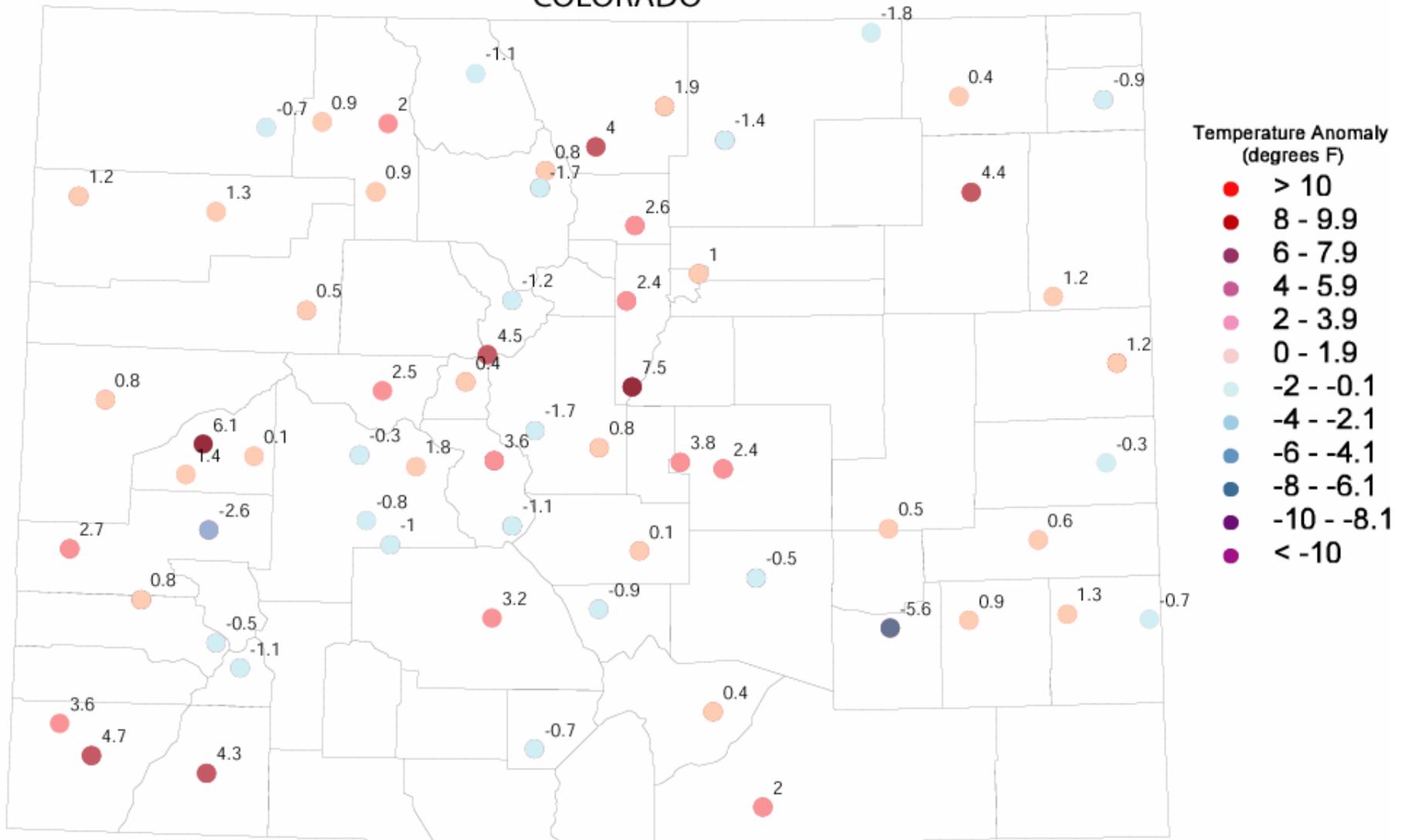


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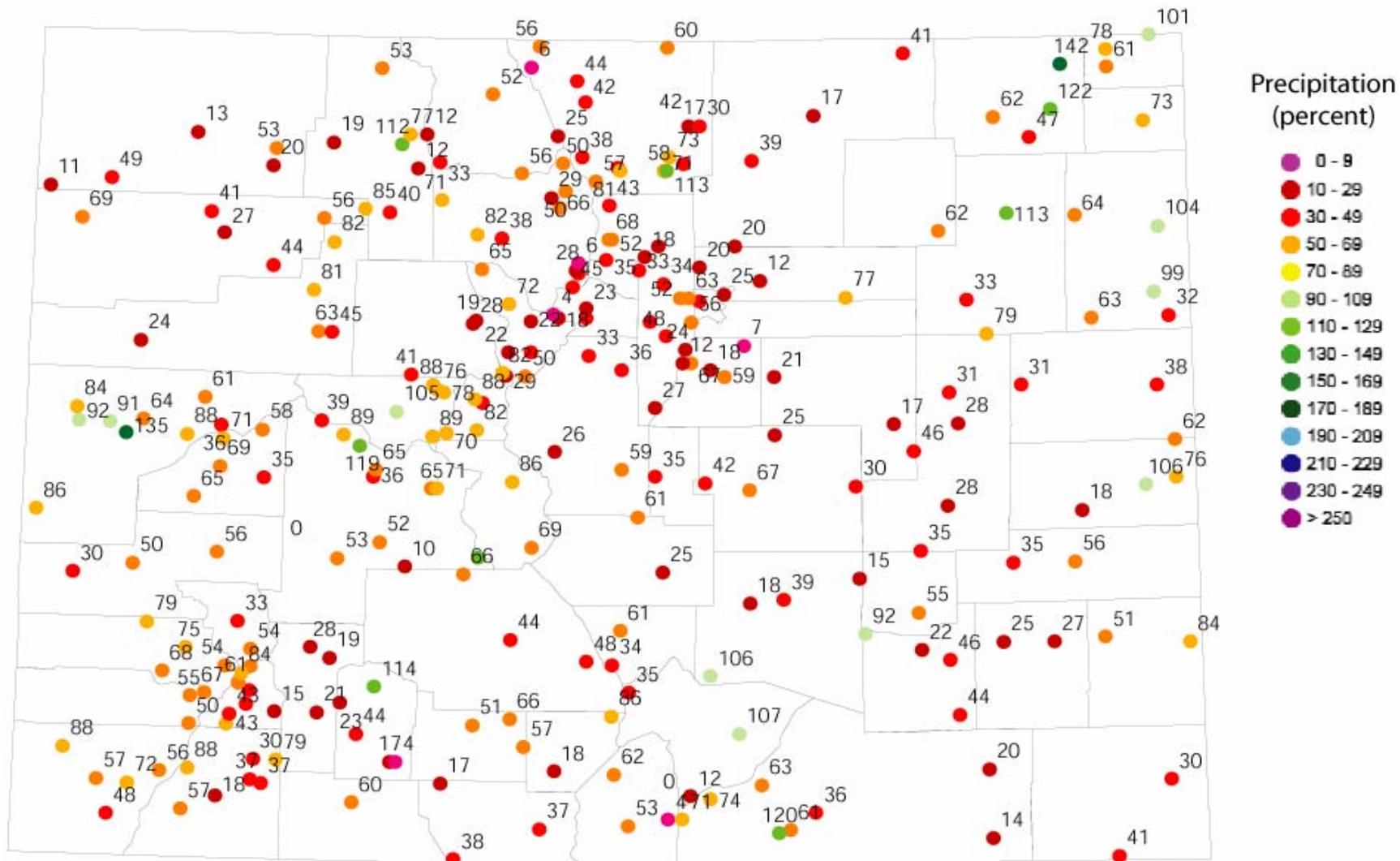
July 2005 average maximum temperature departures from the 1971-2000 averages.

COLORADO



July 2005 average minimum temperature departures from the 1971-2000 averages.

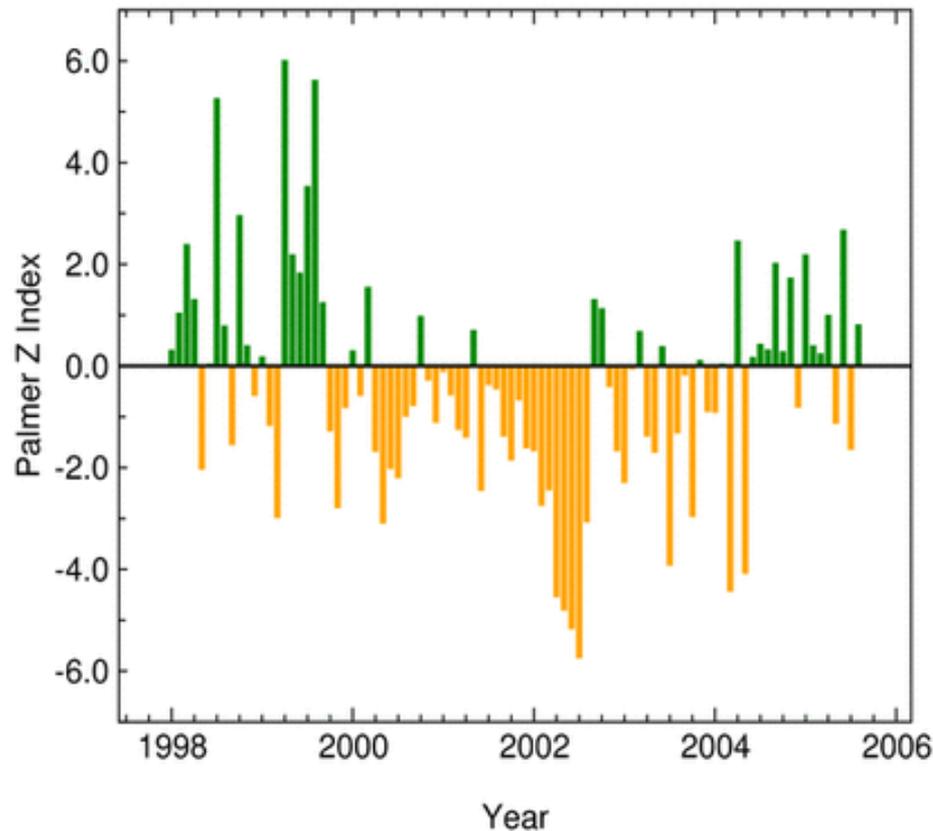
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July 2005 precipitation as a percent of the 1971-2000 average.

August 2005

Colorado Statewide Z Index*
January 1998 - August 2005

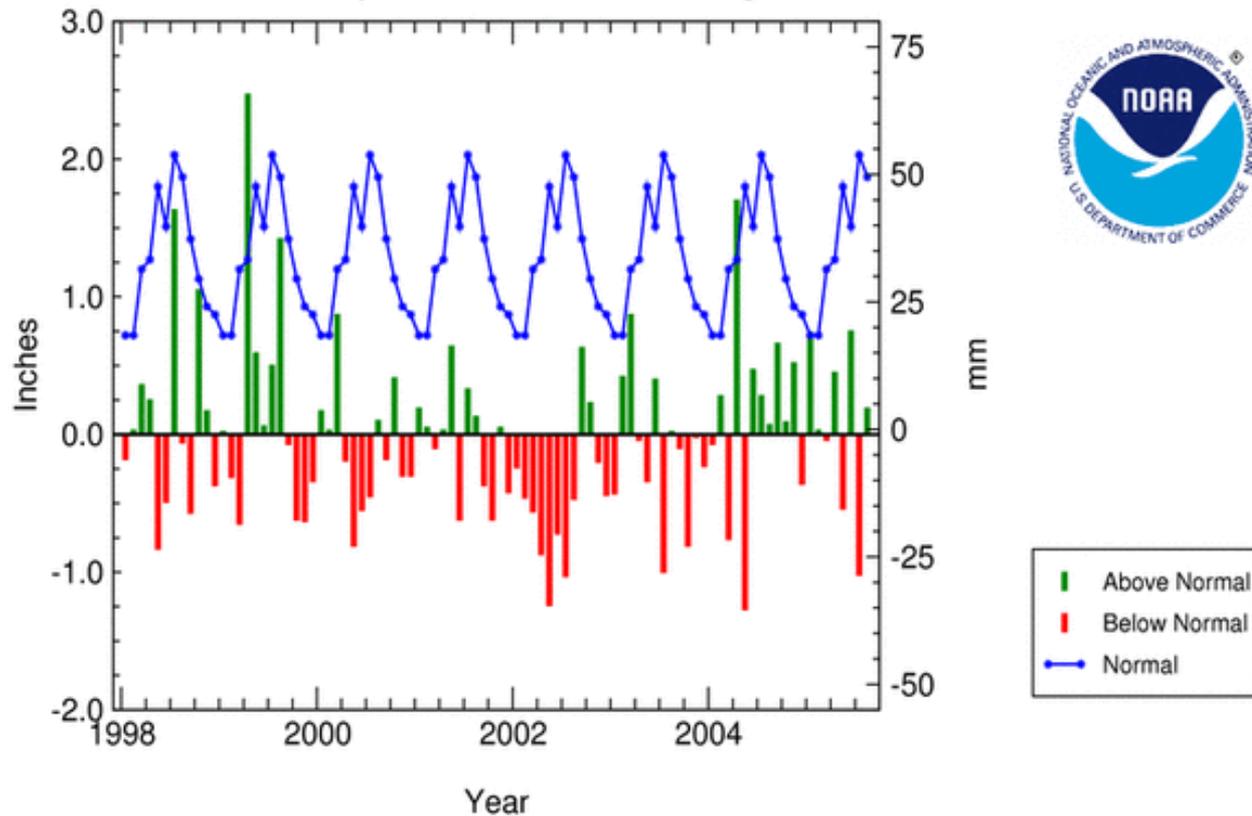


*Palmer Z Index
Short-Term Drought



National Climatic Data Center / NESDIS / NOAA

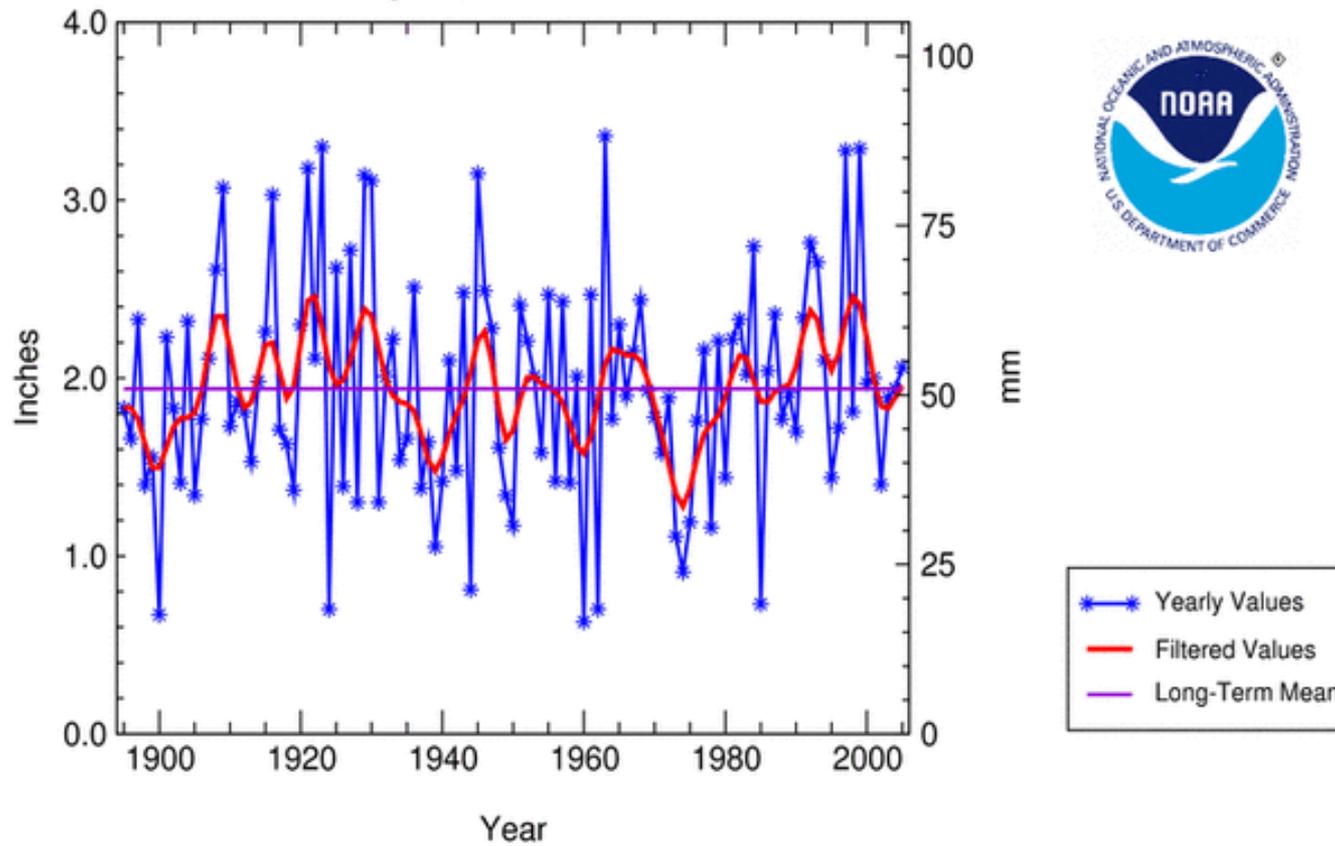
Colorado Statewide Precipitation Normal & Departure, Jan 1998 - Aug 2005



National Climatic Data Center / NESDIS / NOAA



Colorado Statewide Precipitation August, 1895 - 2005



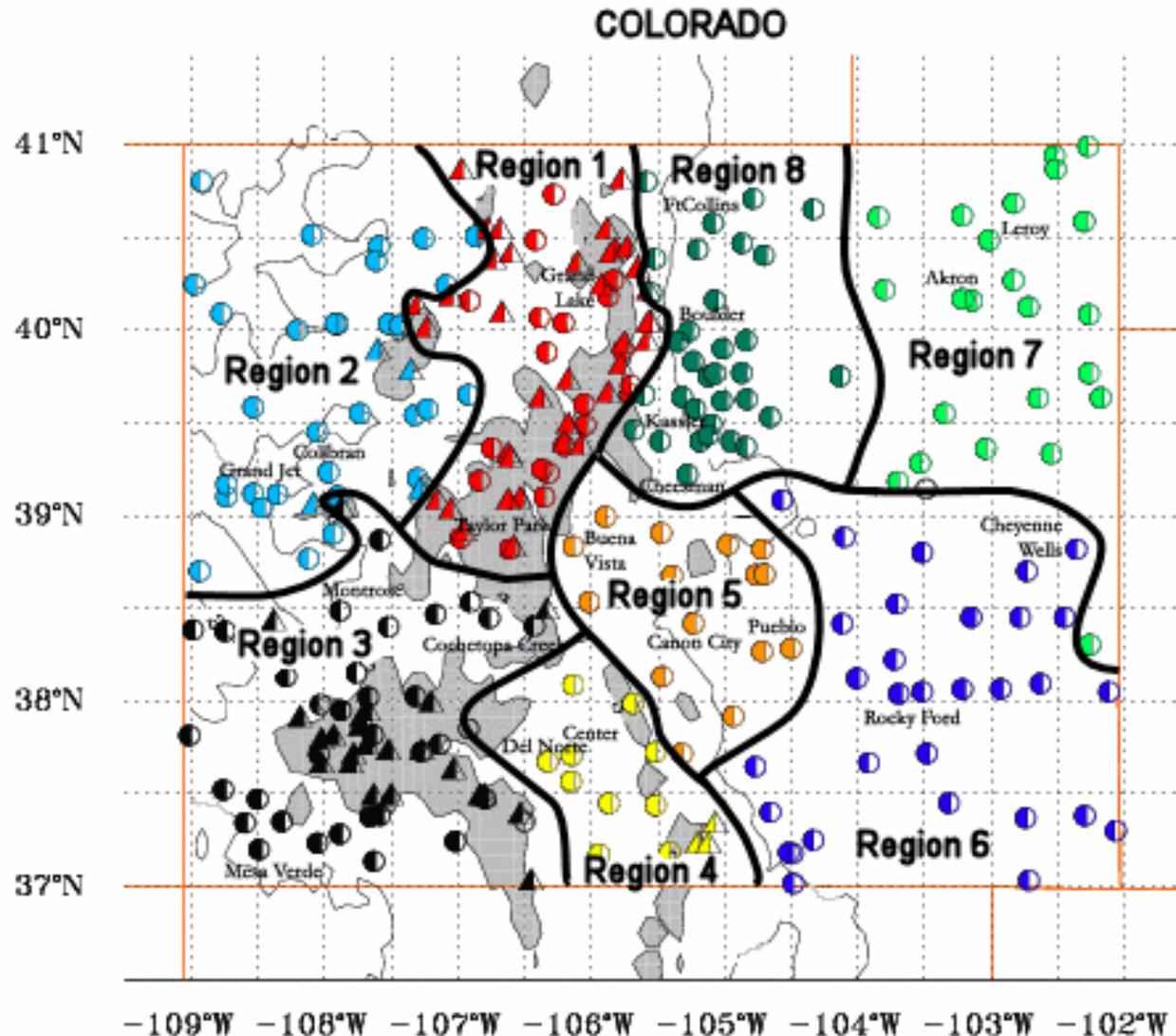
National Climatic Data Center / NESDIS / NOAA

Statewide Precipitation Ranks
for Colorado , 2004-2005

Period	Rank
Aug	<u>45th wettest</u> (<u>67th driest</u>)
Jul-Aug	<u>18th driest</u>
Jun-Aug	<u>53rd driest</u>
May-Aug	<u>39th driest</u>
Apr-Aug	<u>45th driest</u>
Mar-Aug	<u>41st driest</u>
Feb-Aug	<u>38th driest</u>
Jan-Aug	<u>54th wettest</u> (<u>57th driest</u>)
Dec-Aug	<u>52nd driest</u>
Nov-Aug	<u>44th wettest</u> (<u>67th driest</u>)
Oct-Aug	<u>52nd wettest</u> (<u>59th driest</u>)
Sep-Aug	<u>37th wettest</u> (<u>74th driest</u>)

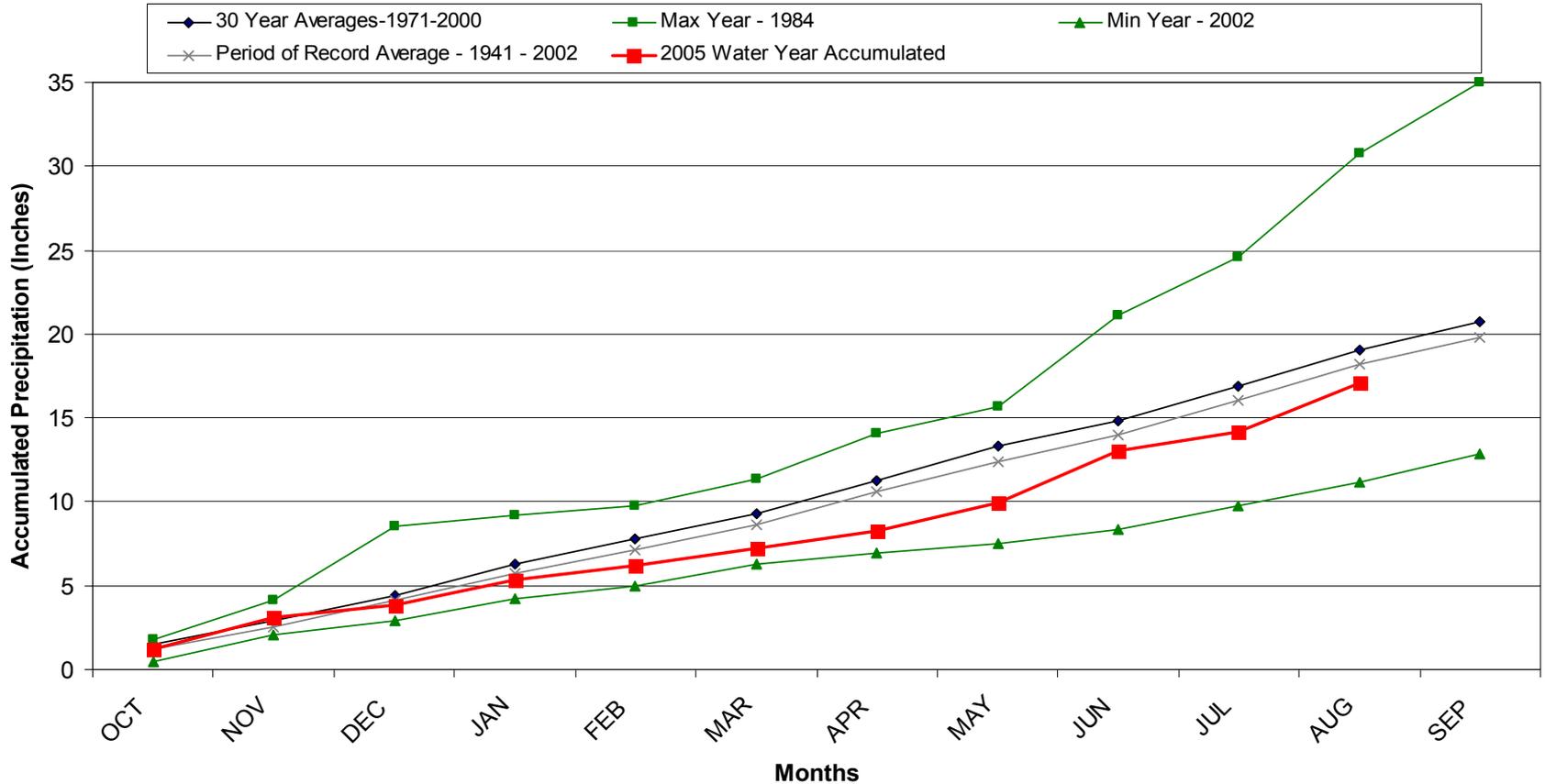
Colorado
Precipitation
Ranking
1895-2005

Climate divisions defined by Dr. Klaus Wolter of NOAA's Climate Diagnostic Center in Boulder, CO



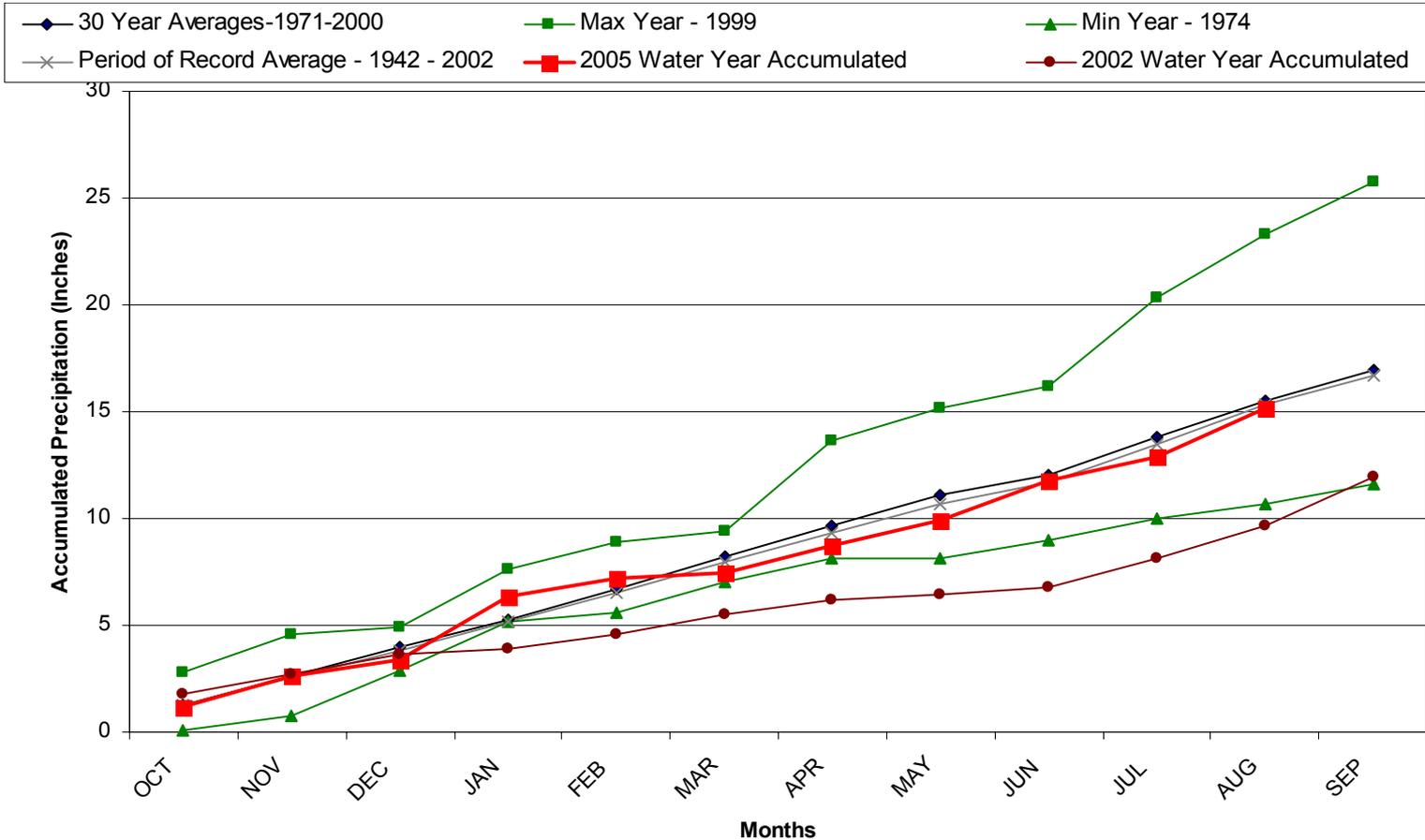
Division 1– Grand Lake 1NW

Grand Lake 1 NW 2005 Water Year



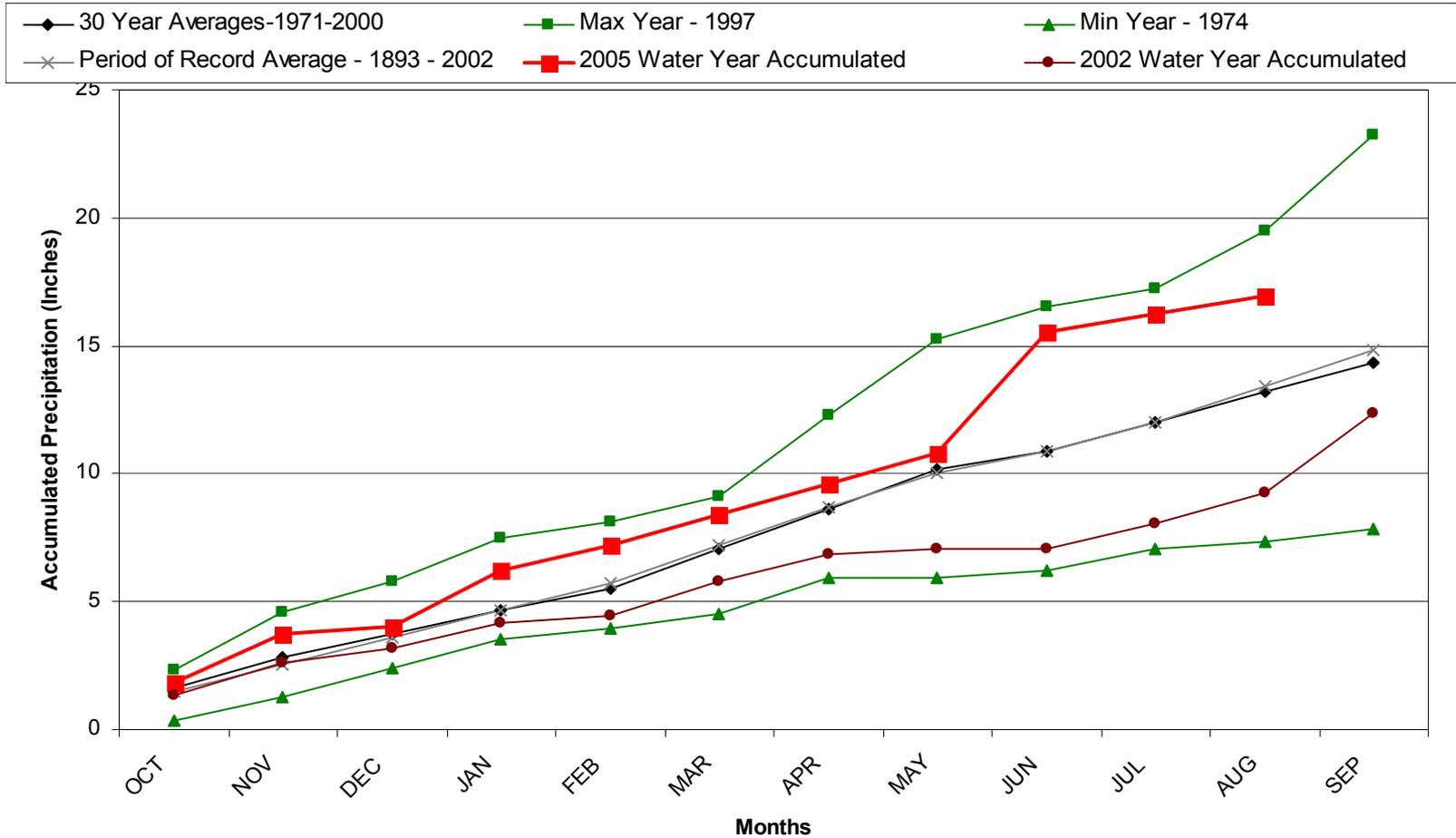
Division 1– Taylor Park

Taylor Park 2005 Water Year



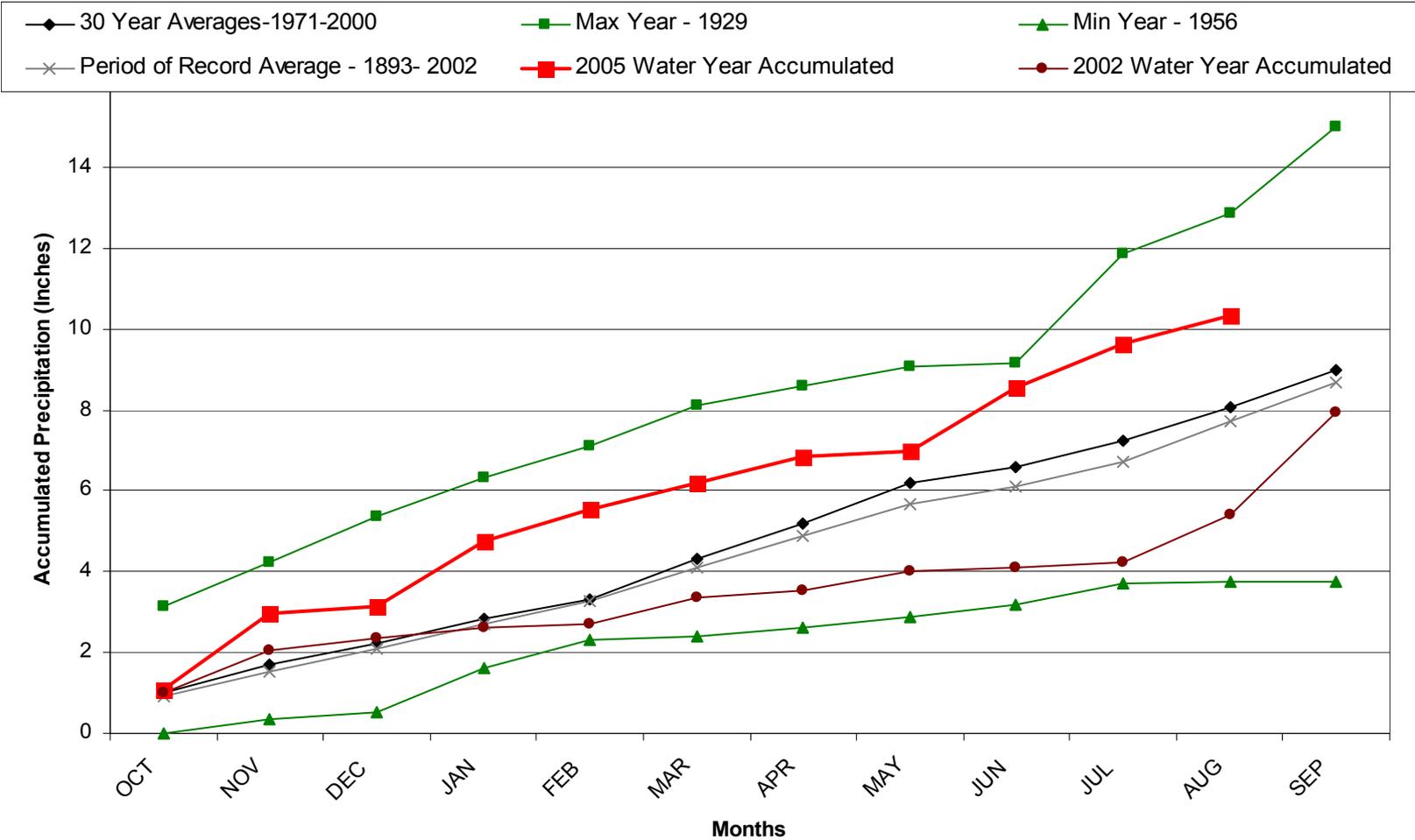
Division 2– Collbran

Collbran 2SW 2005 Water Year



Division 2 – Grand Junction

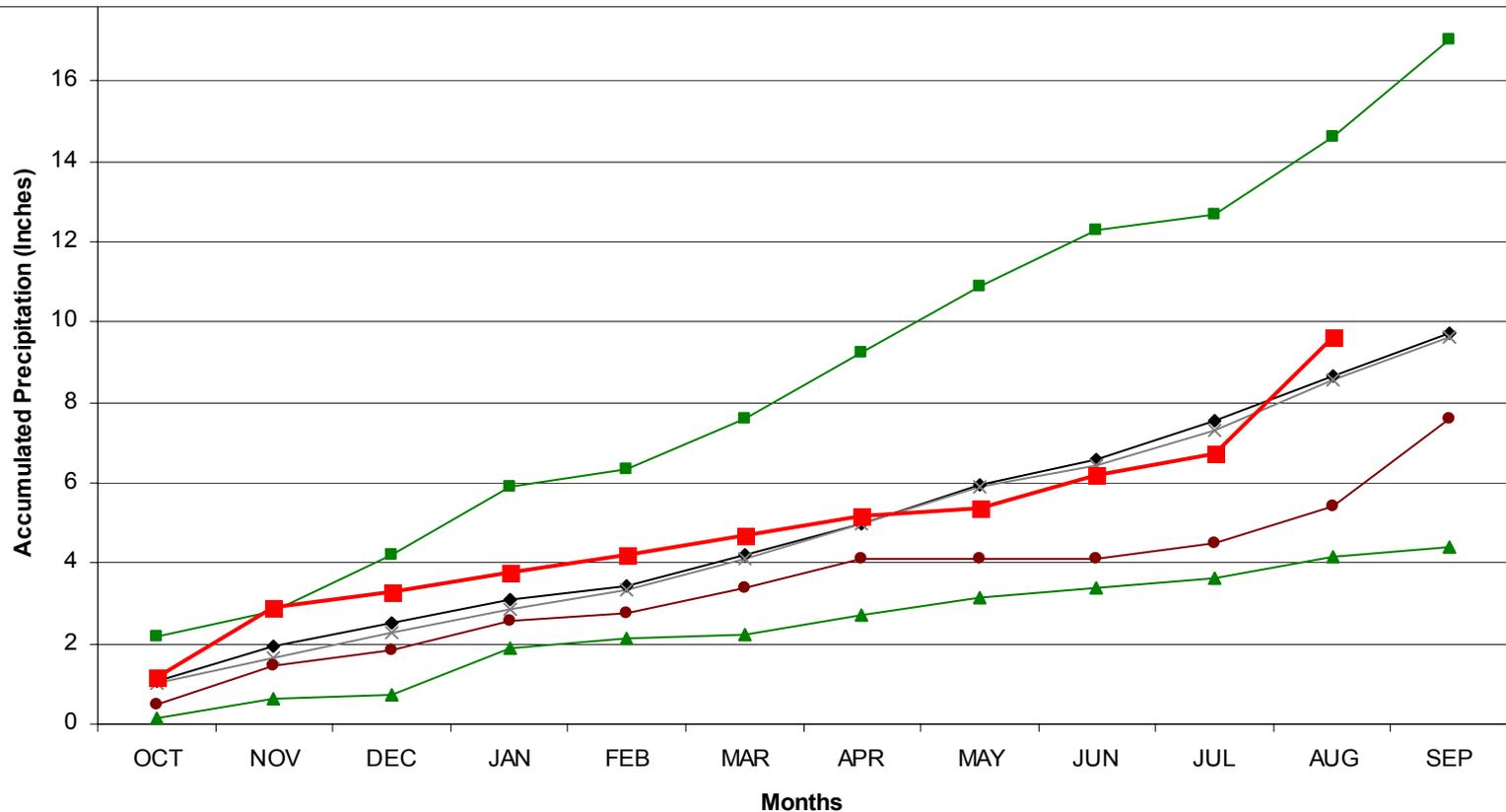
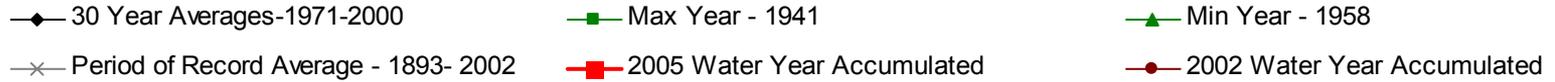
Grand Junction WSFO 2005 Water Year



Division 3 – Montrose

Montrose #2

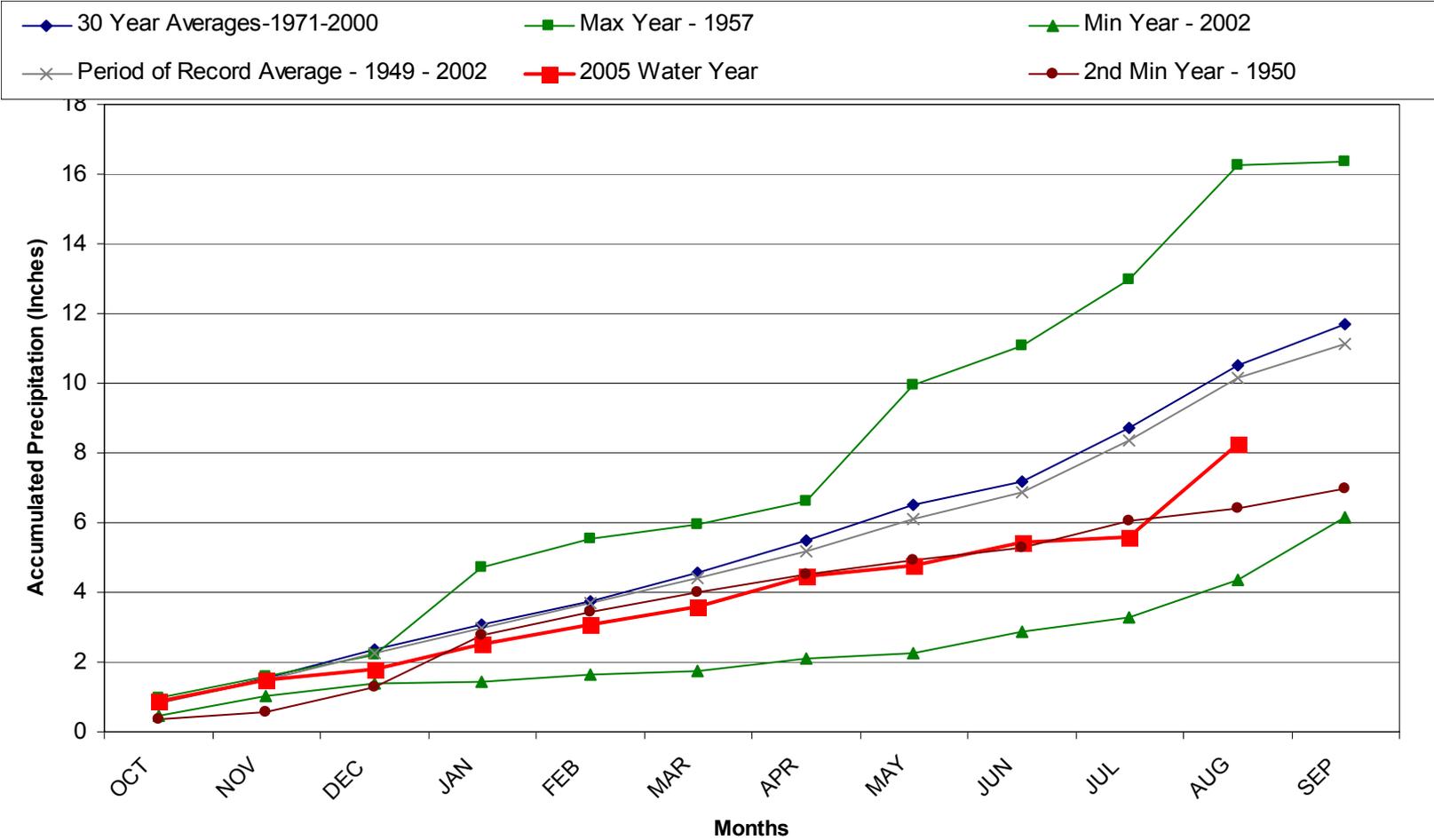
2005 Water Year



Division 3 – Cochetopa Creek

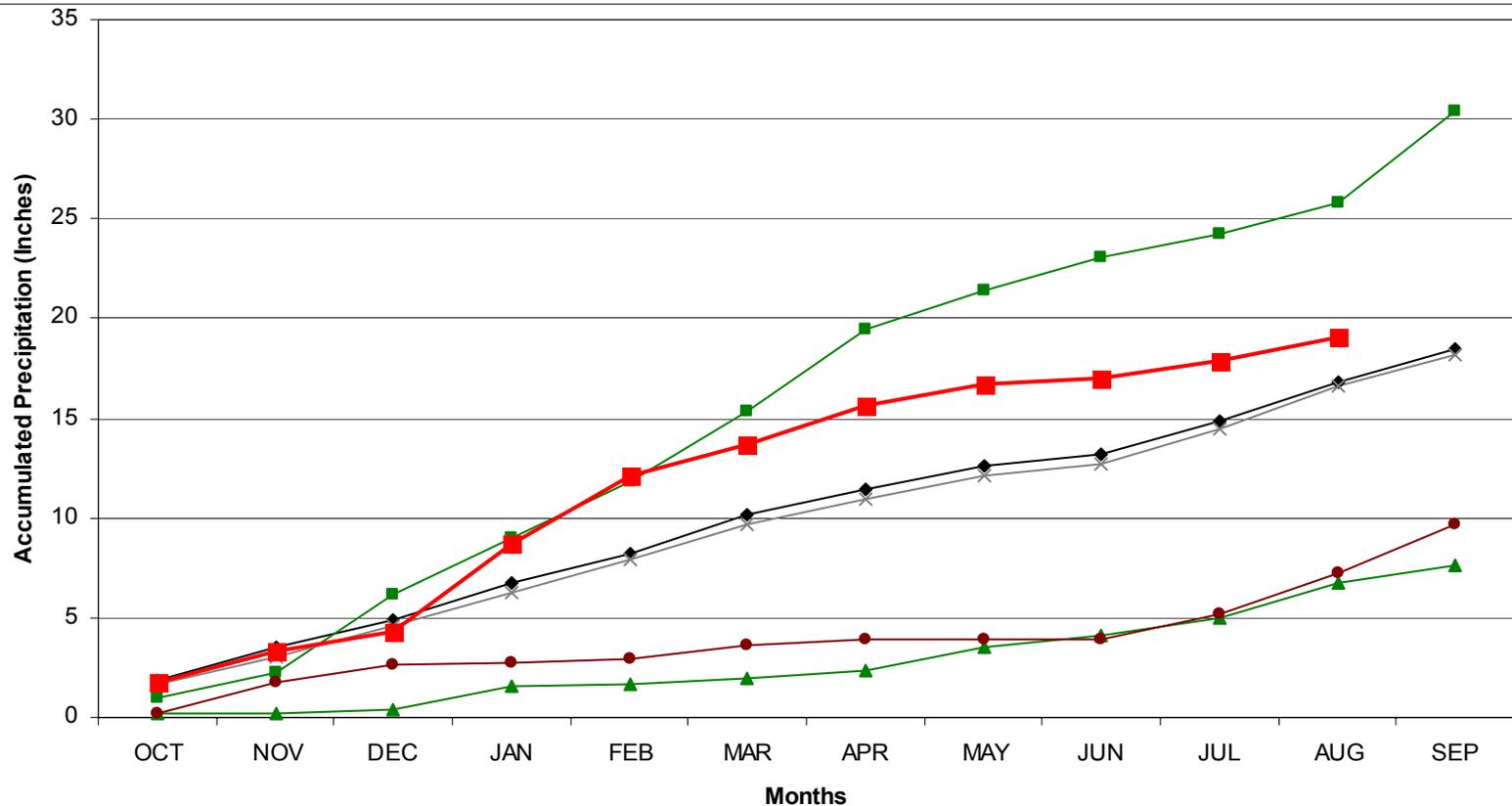
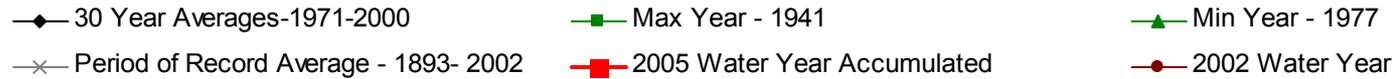
Cochetopa Creek

2005 Water Year



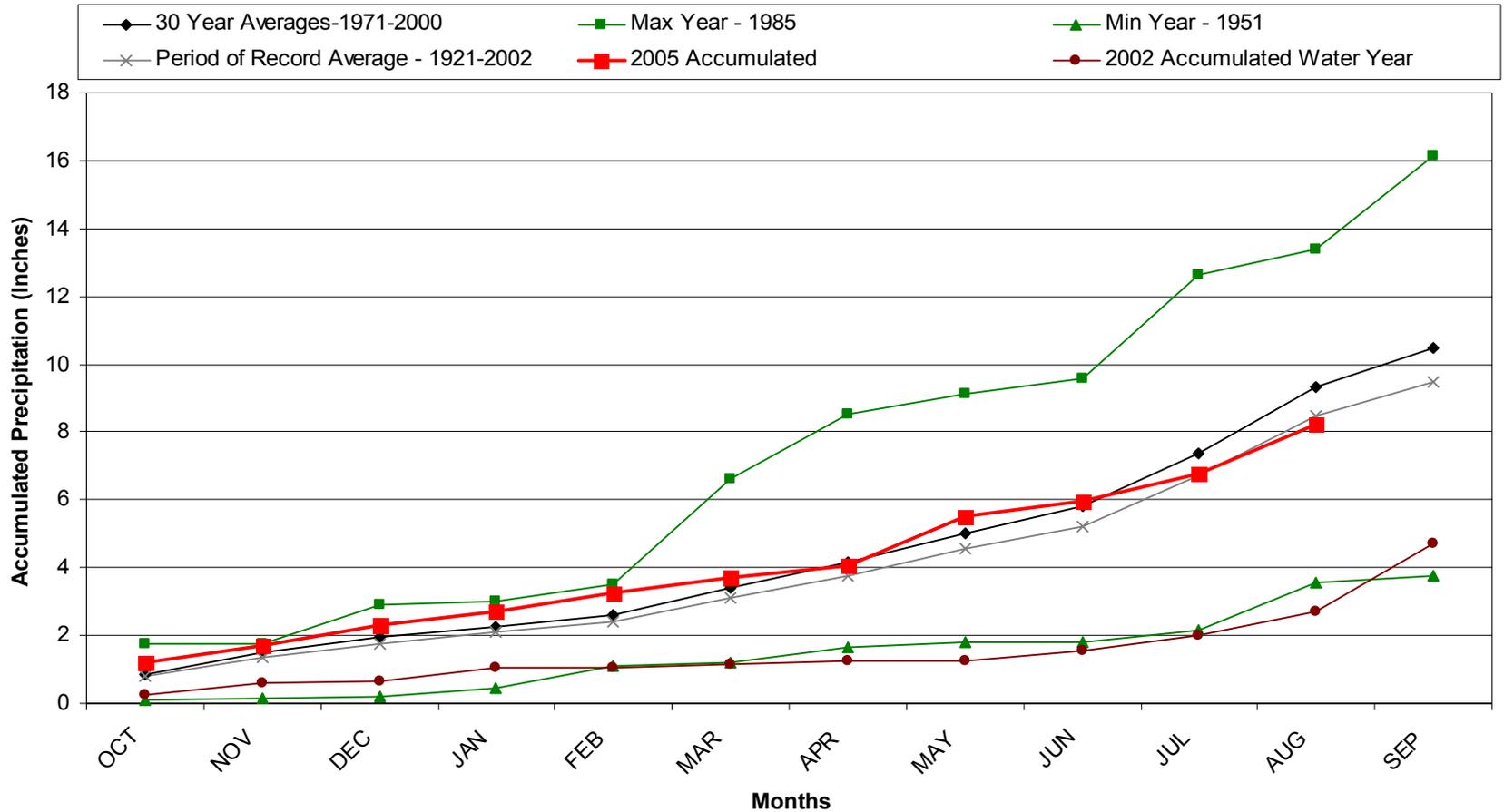
Division 3 – Mesa Verde

Mesa Verde NP 2005 Water Year



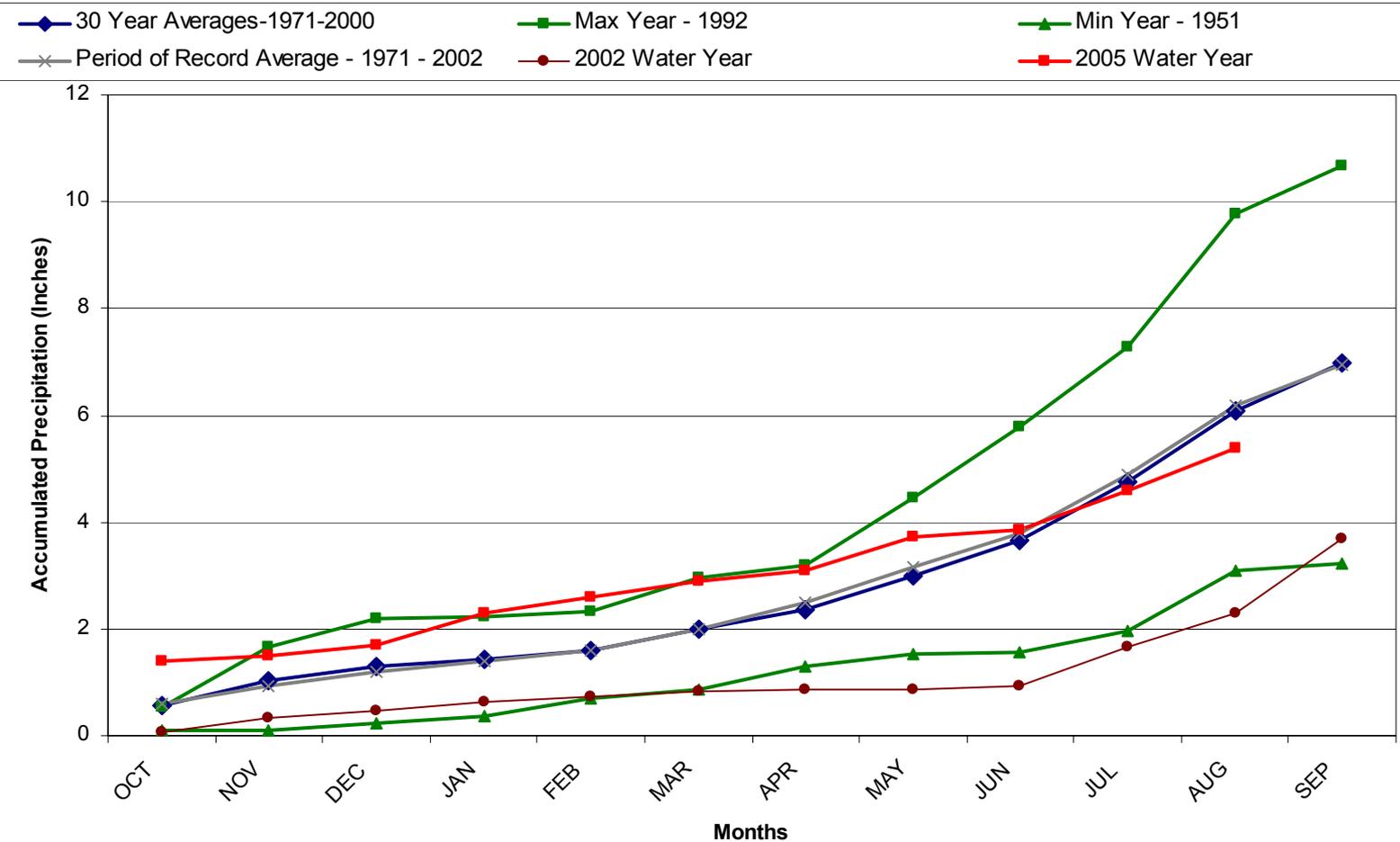
Division 4 – Del Norte

Del Norte 2005 Water Year



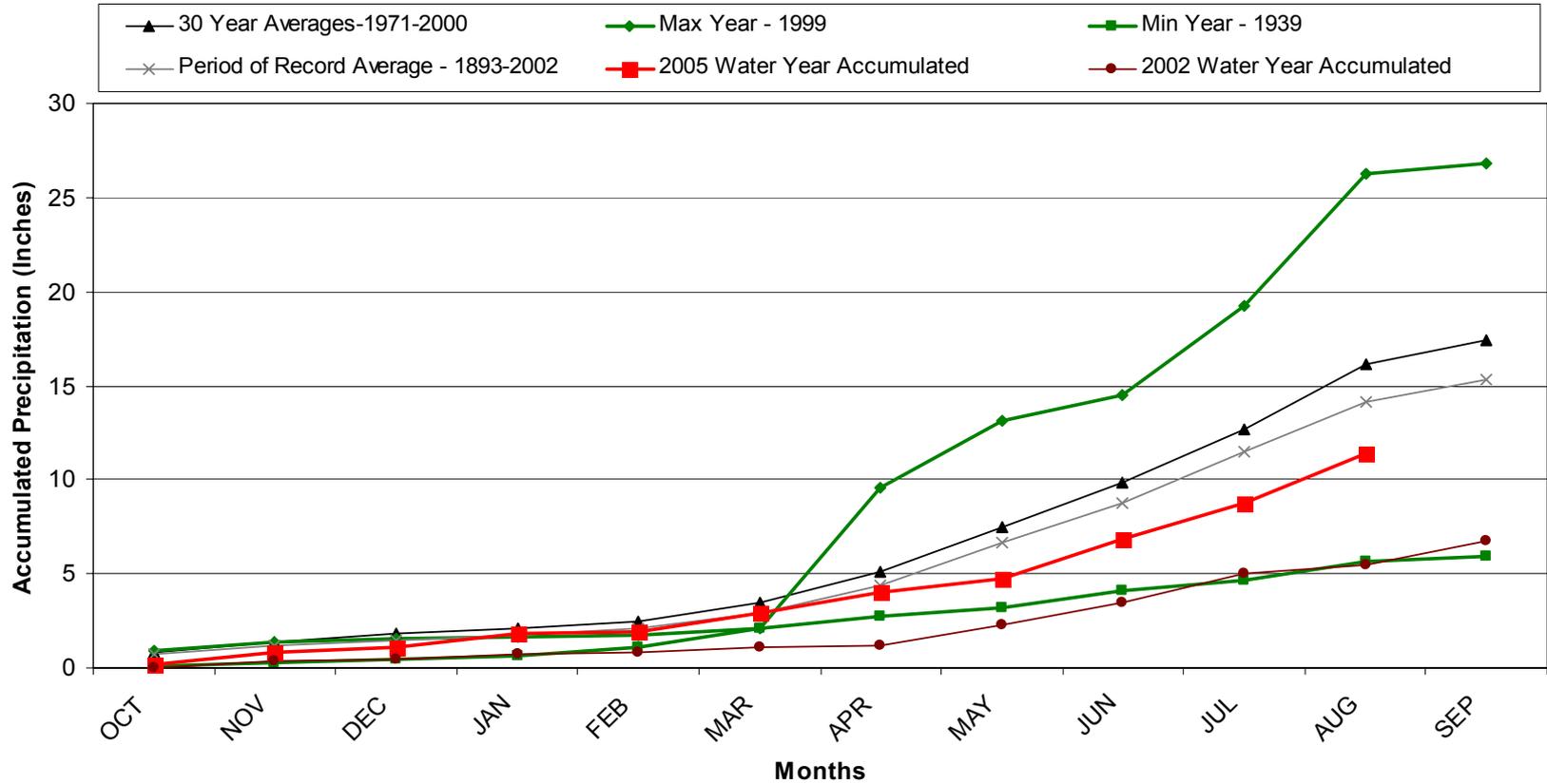
Division 4 – Center 4SSW

Center 4SSW 2005 Water Year



Division 5 – Colorado Springs

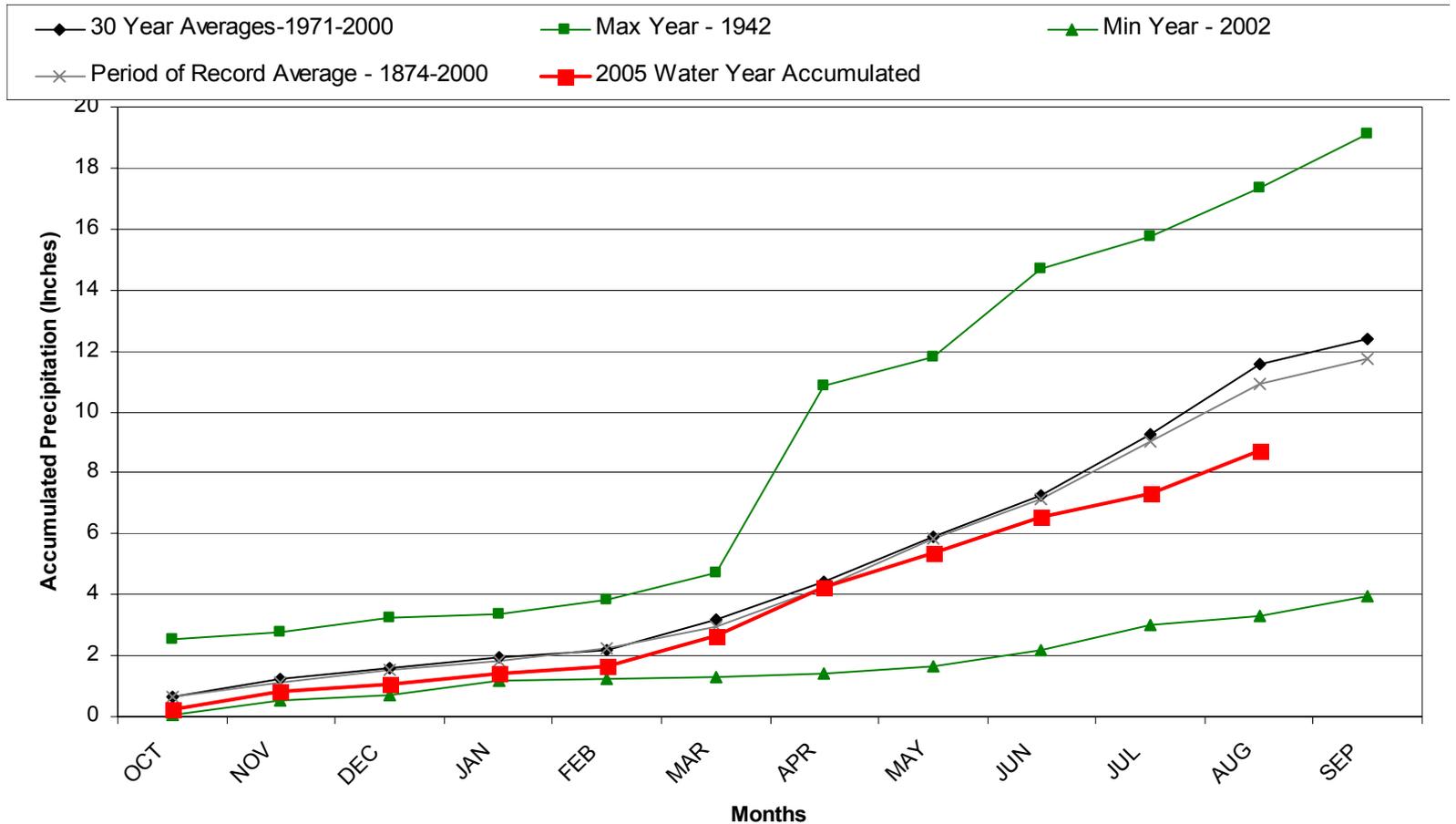
Colorado Springs 2005 Water Year



Division 5 – Pueblo

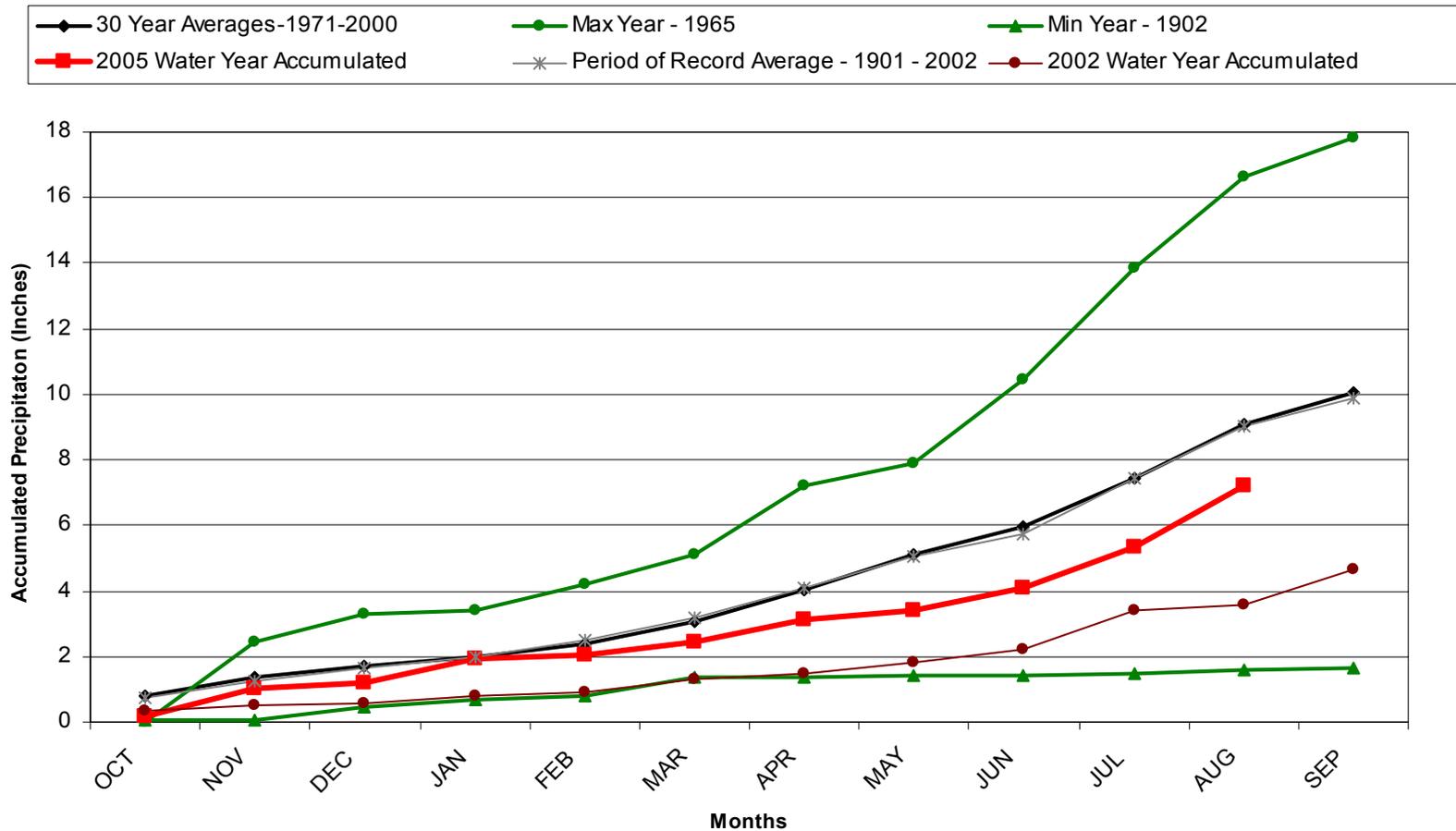
Pueblo WSO

2005 Water Year



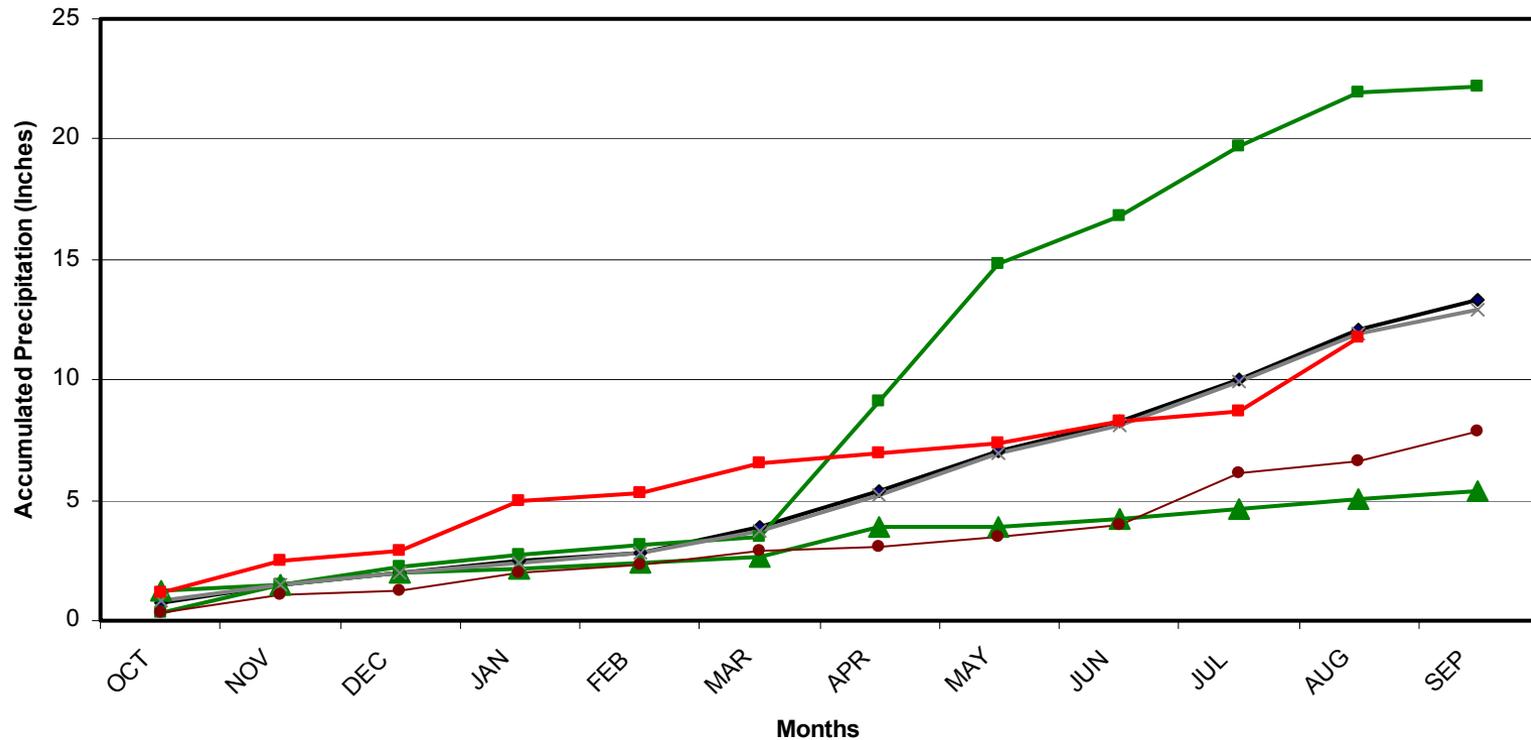
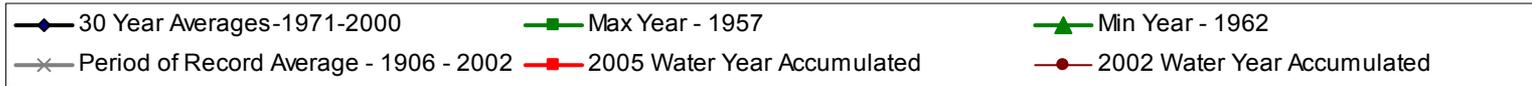
Division 5 – Buena Vista

Buena Vista 2005 Water Year



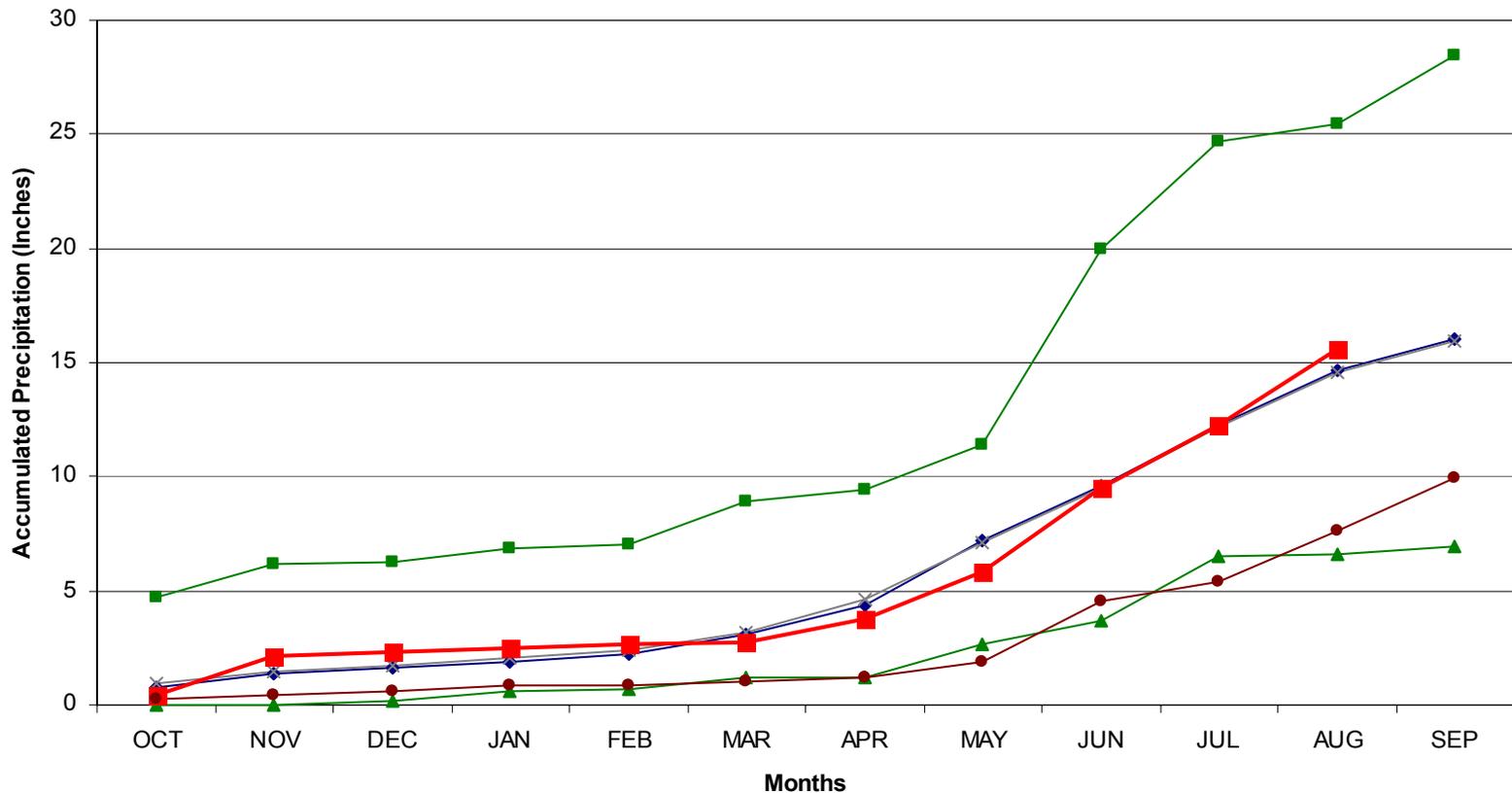
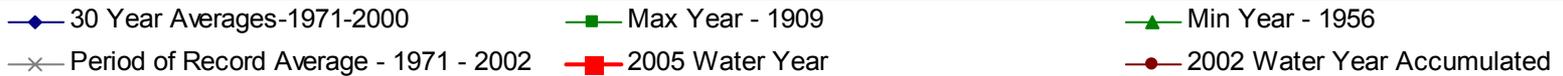
Division 5 – Canon City

Canon City 2005 Water Year



Division 6 – Cheyenne Wells

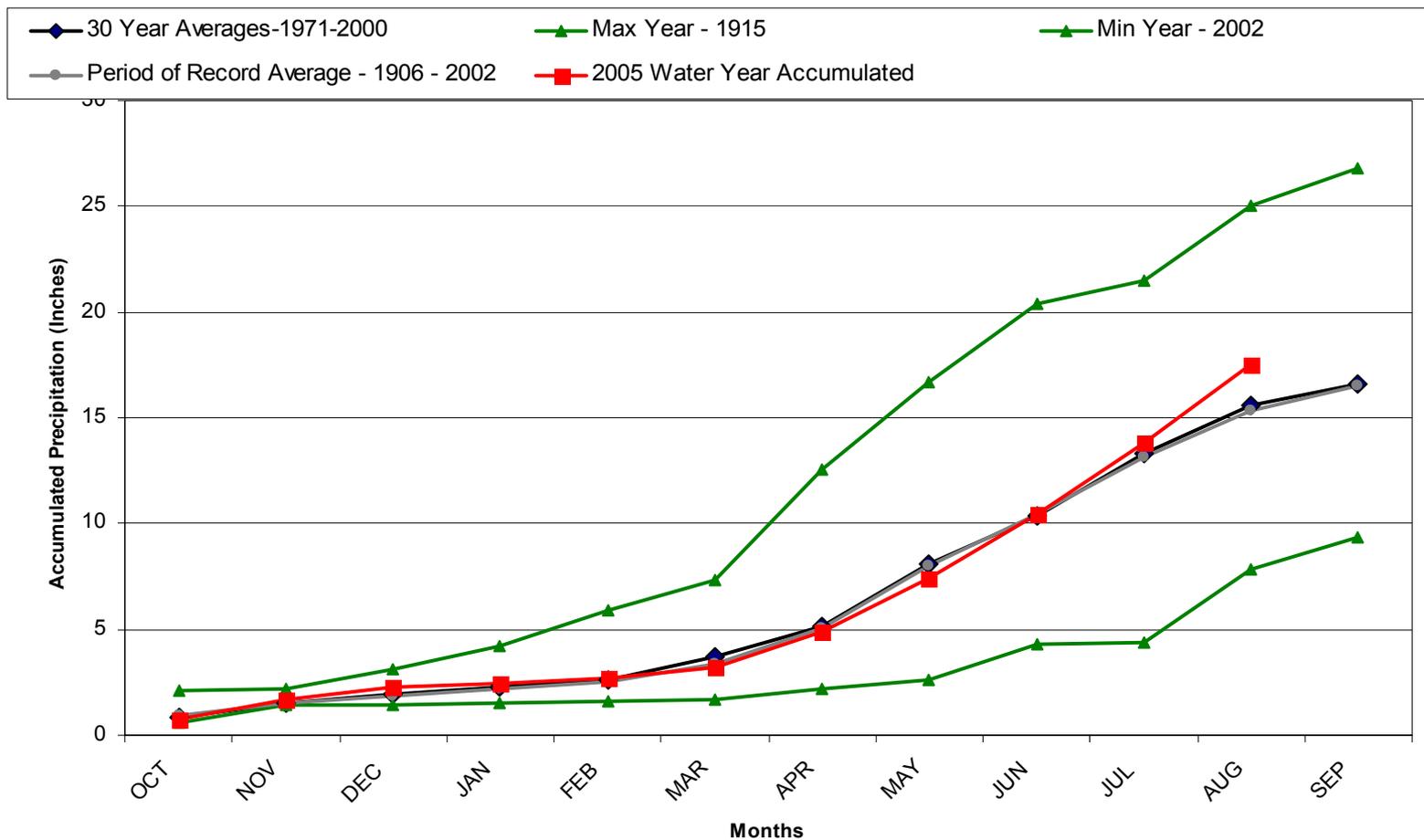
Cheyenne Wells 2005 Water Year



Division 7 – Akron

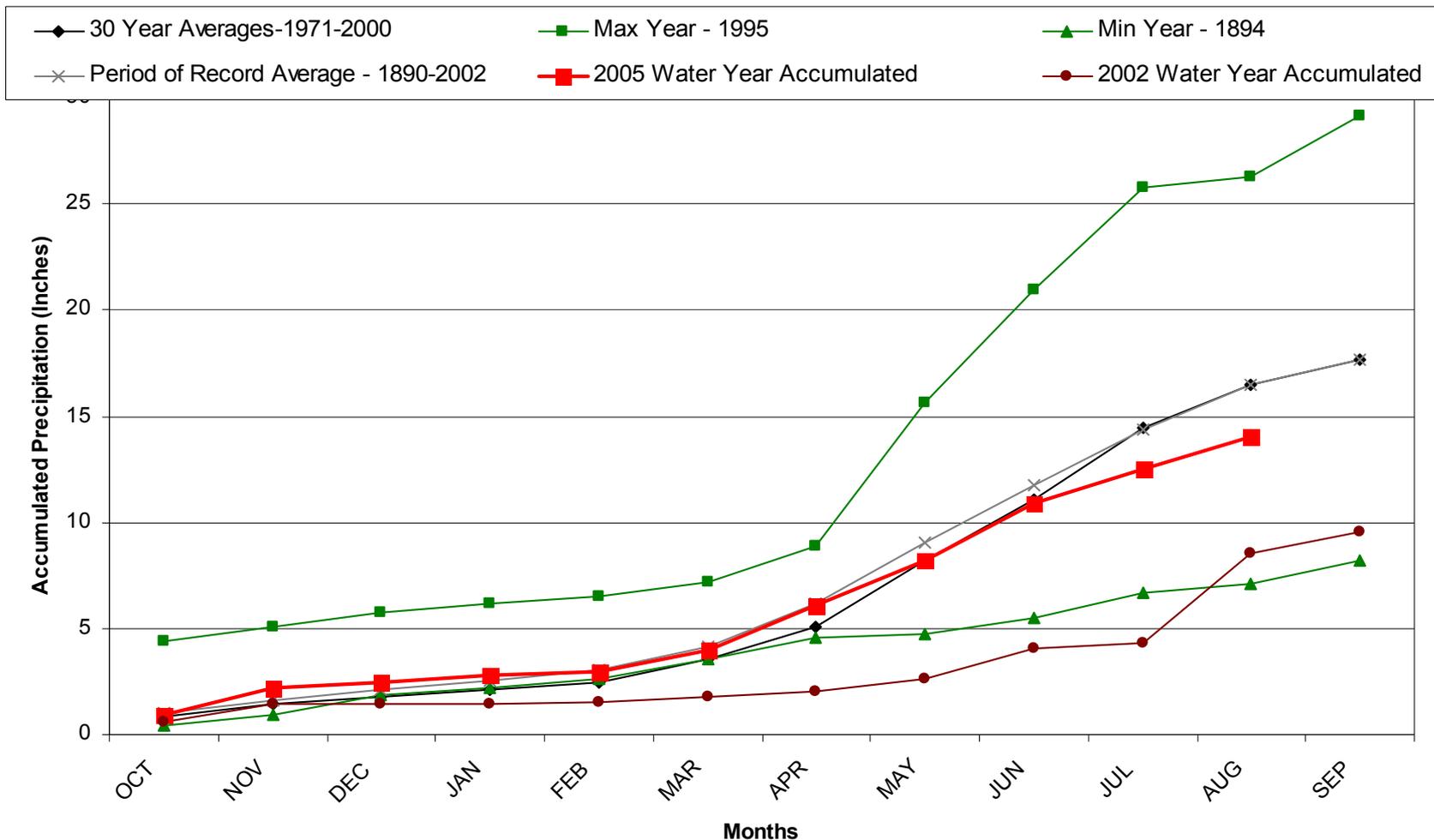
Akron 4E

2005 Water Year



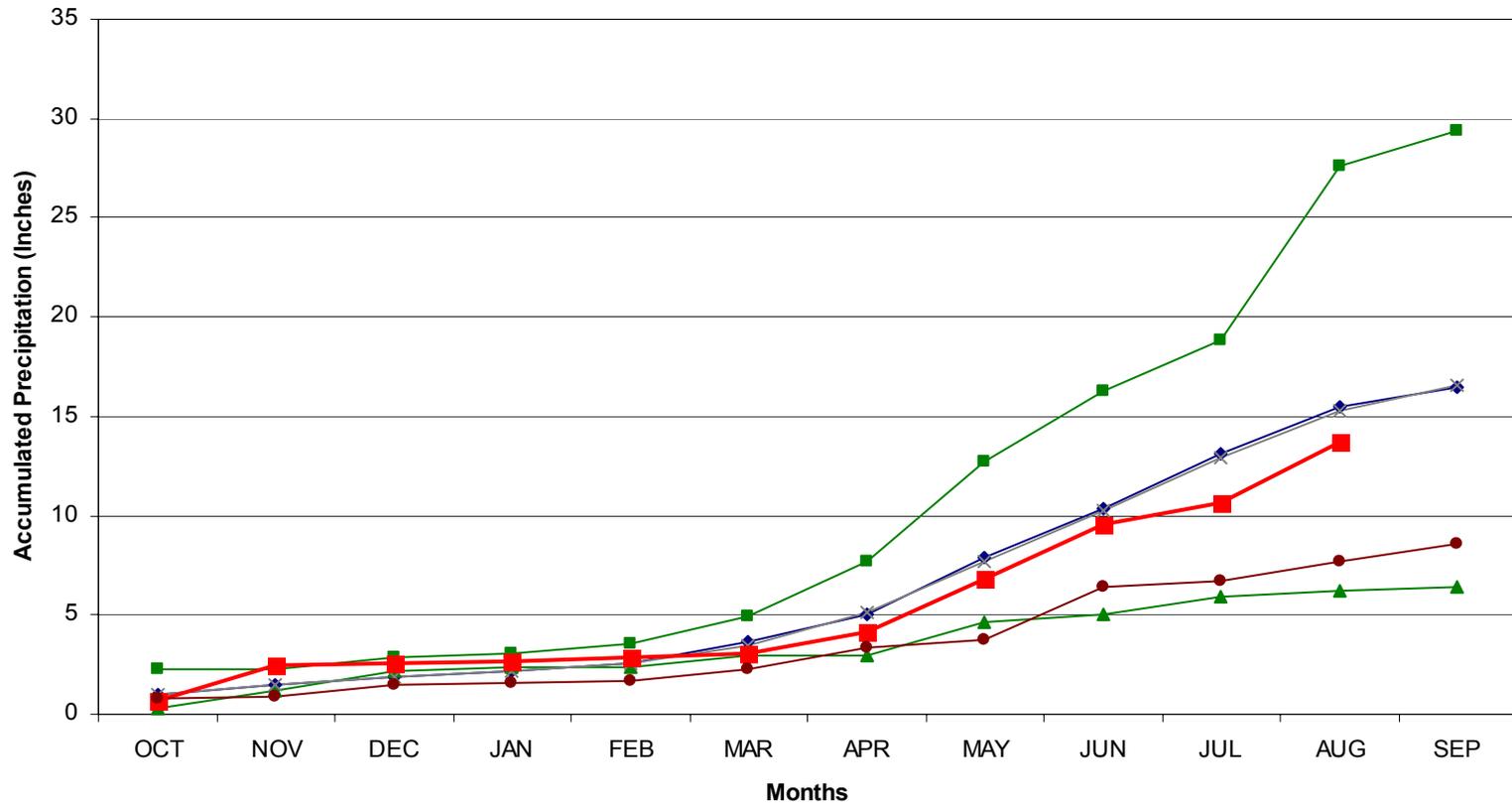
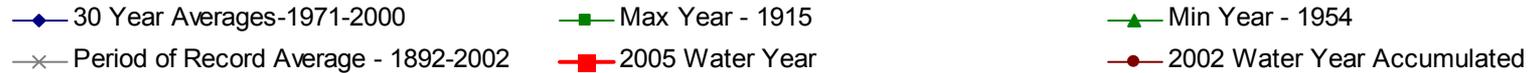
Division 7 – Leroy

Leroy 5SW 2005 Water Year



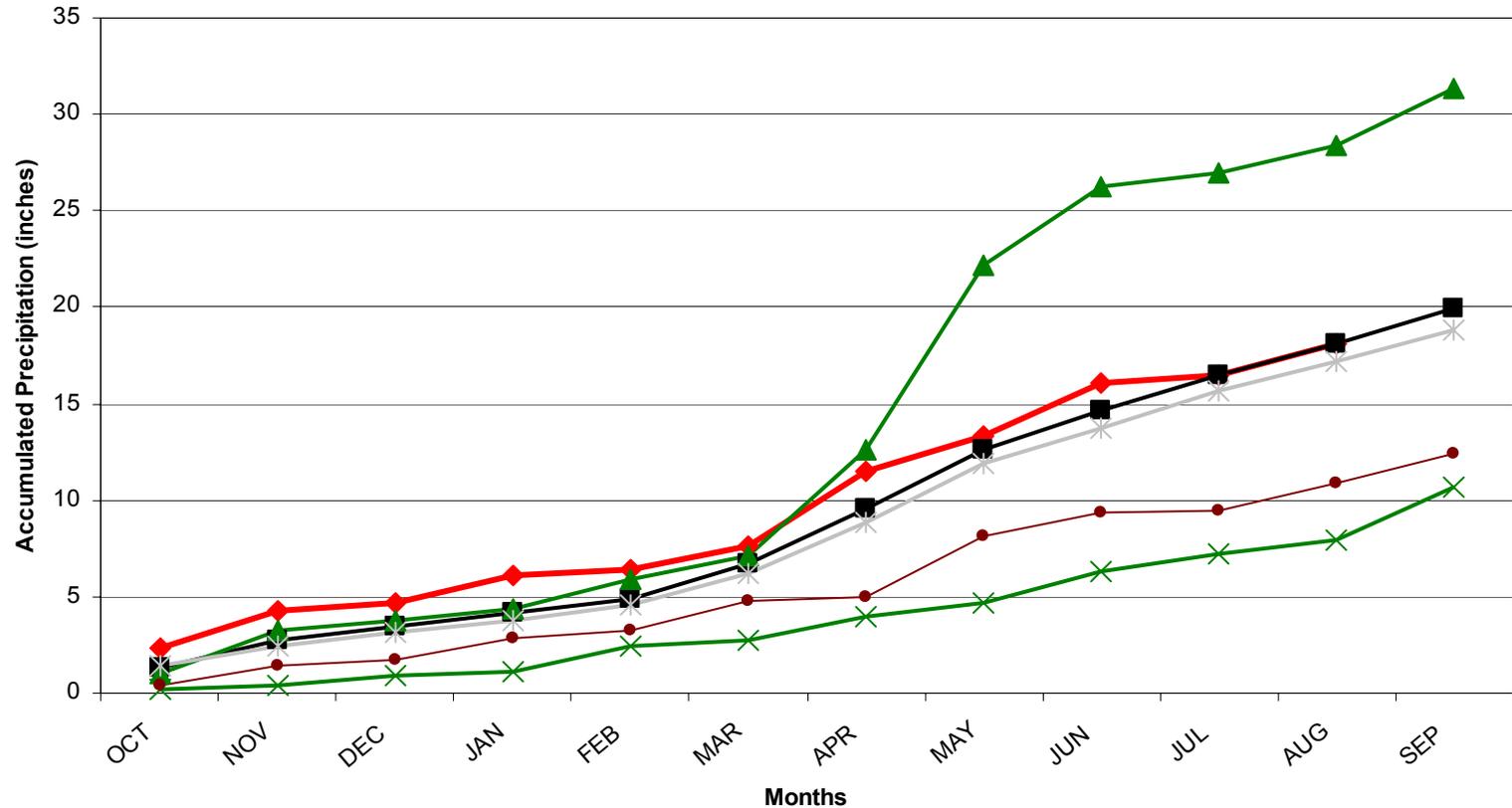
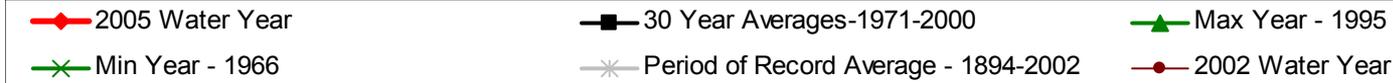
Division 7 – Burlington

Burlington 2005 Water Year



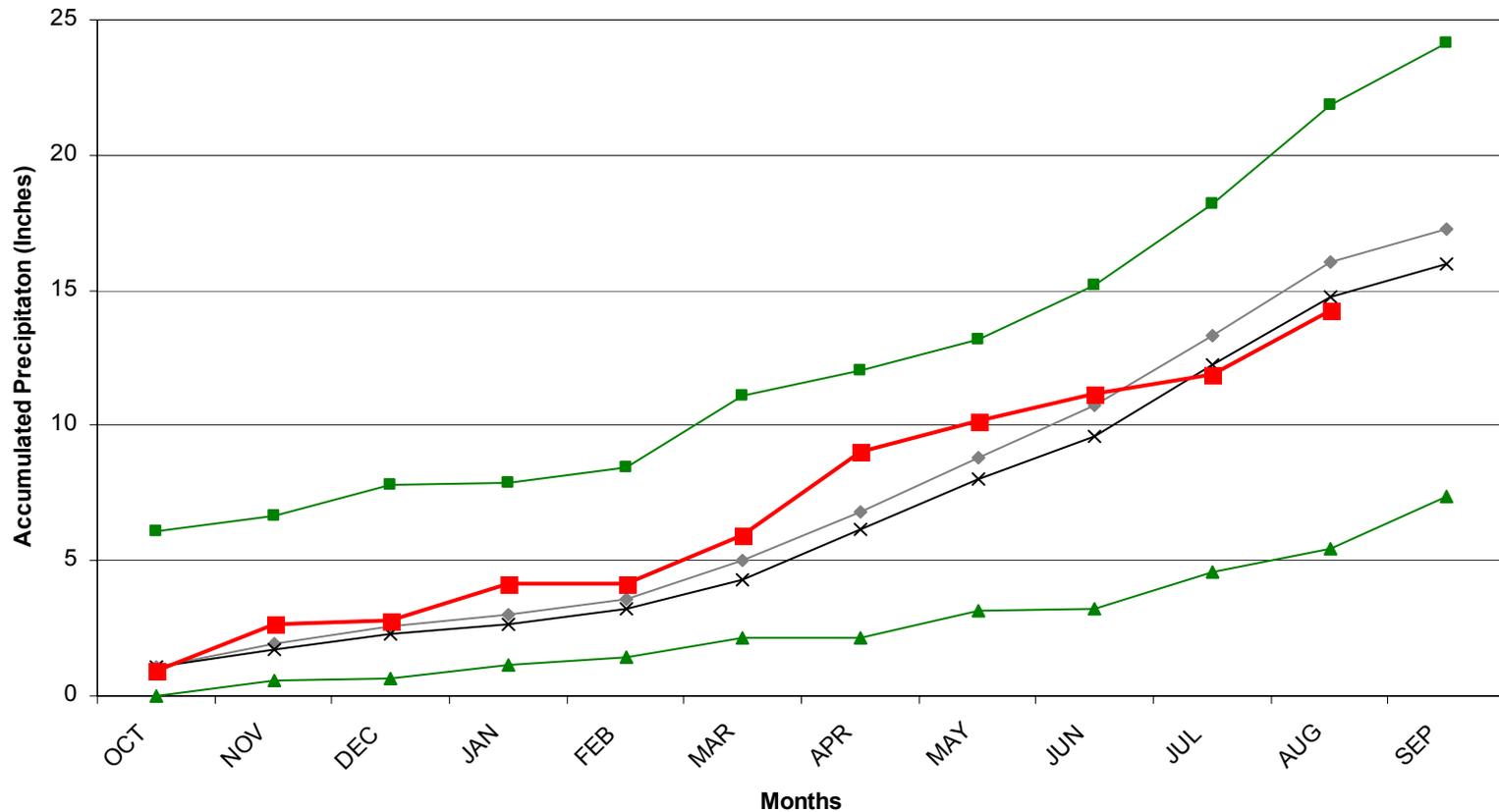
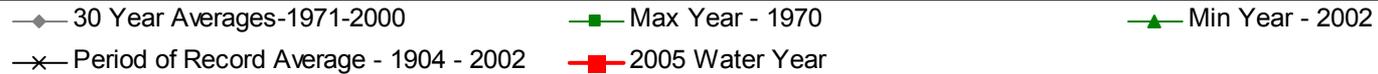
Division 8 – Boulder

Boulder 2005 Water Year



Division 8 – Cheesman

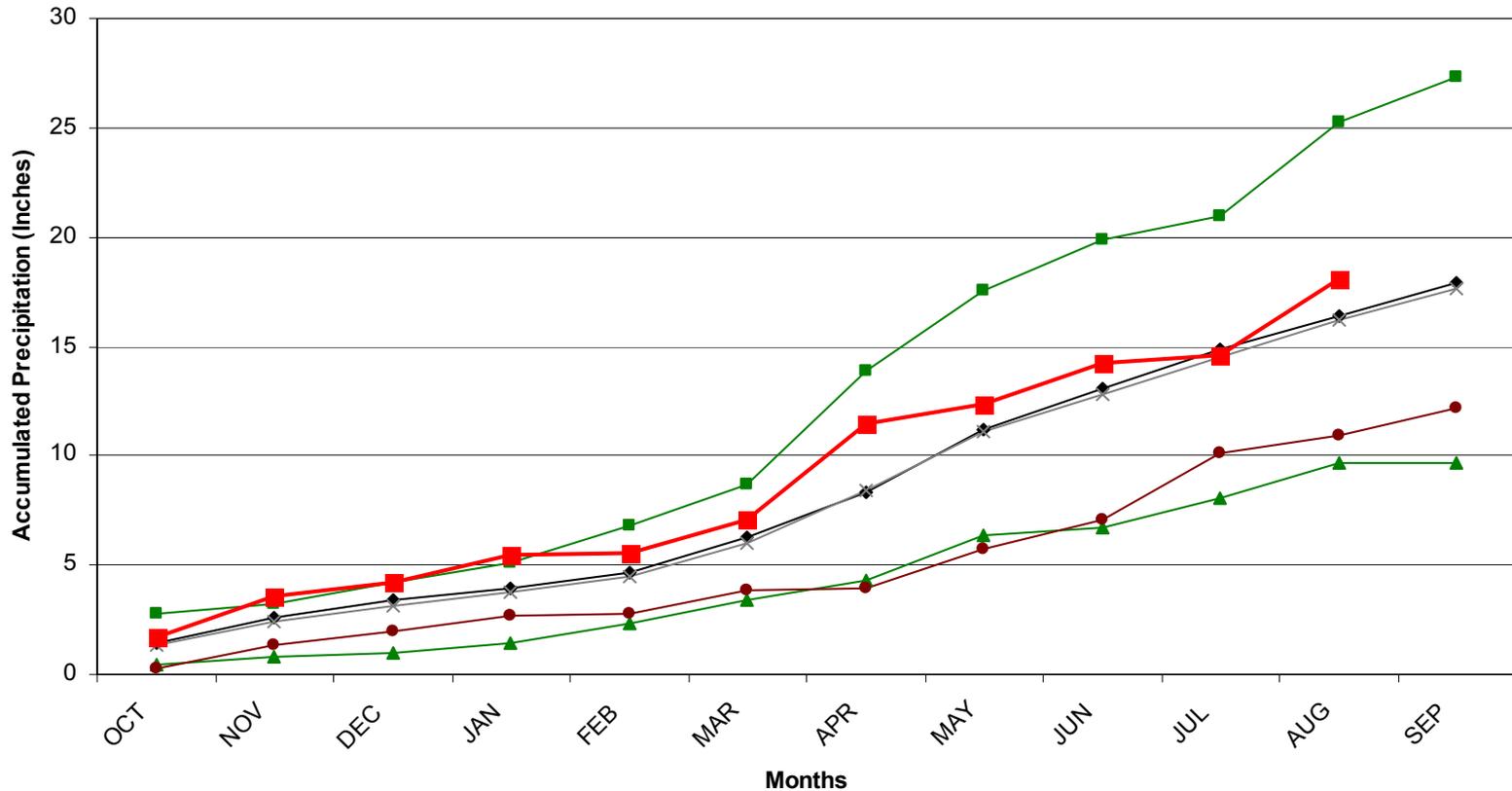
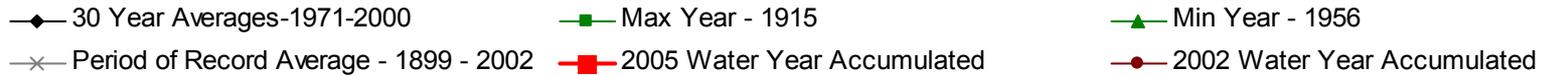
Cheesman 2005 Water Year



Division 8 – Kassler

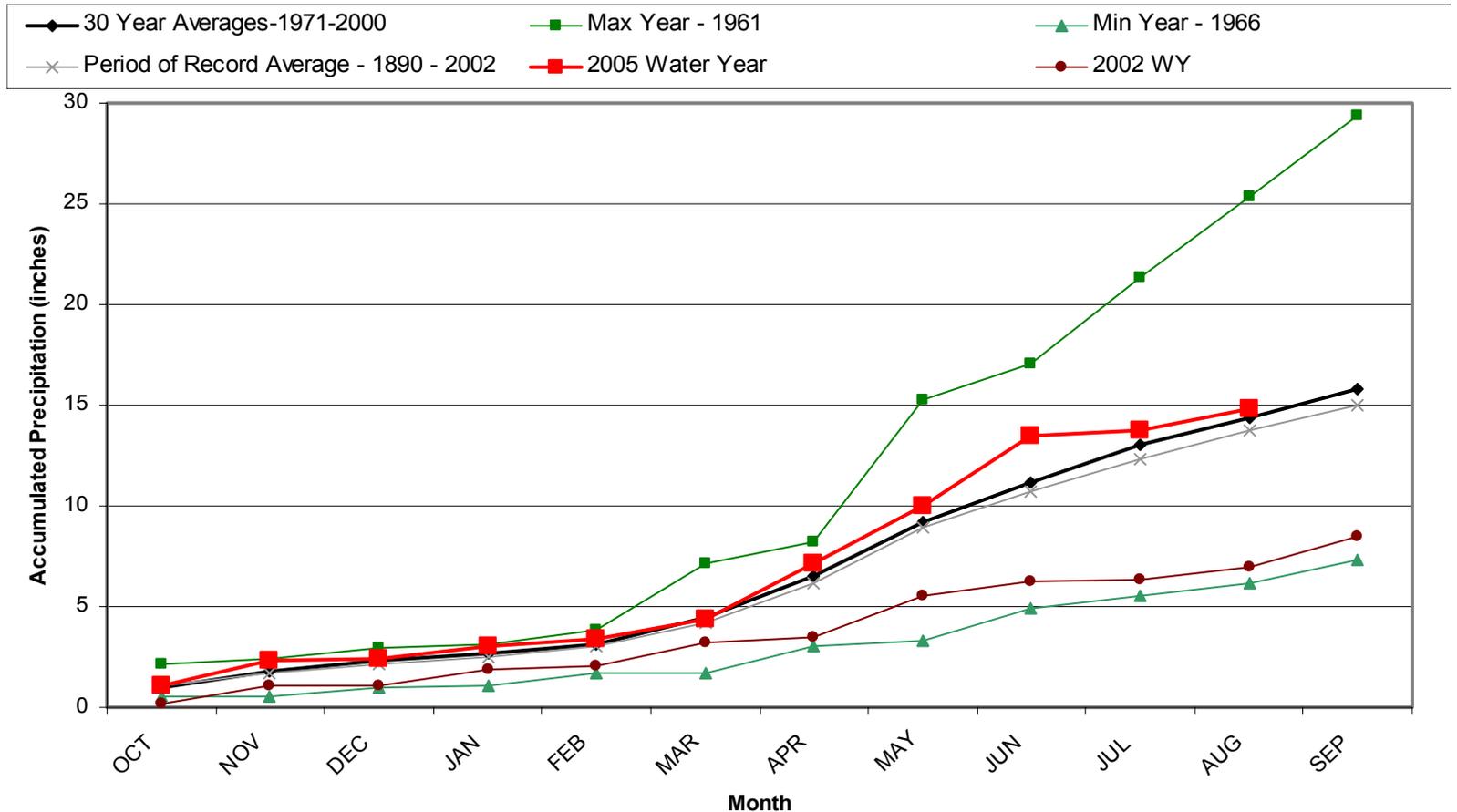
Kassler

2005 Water Year

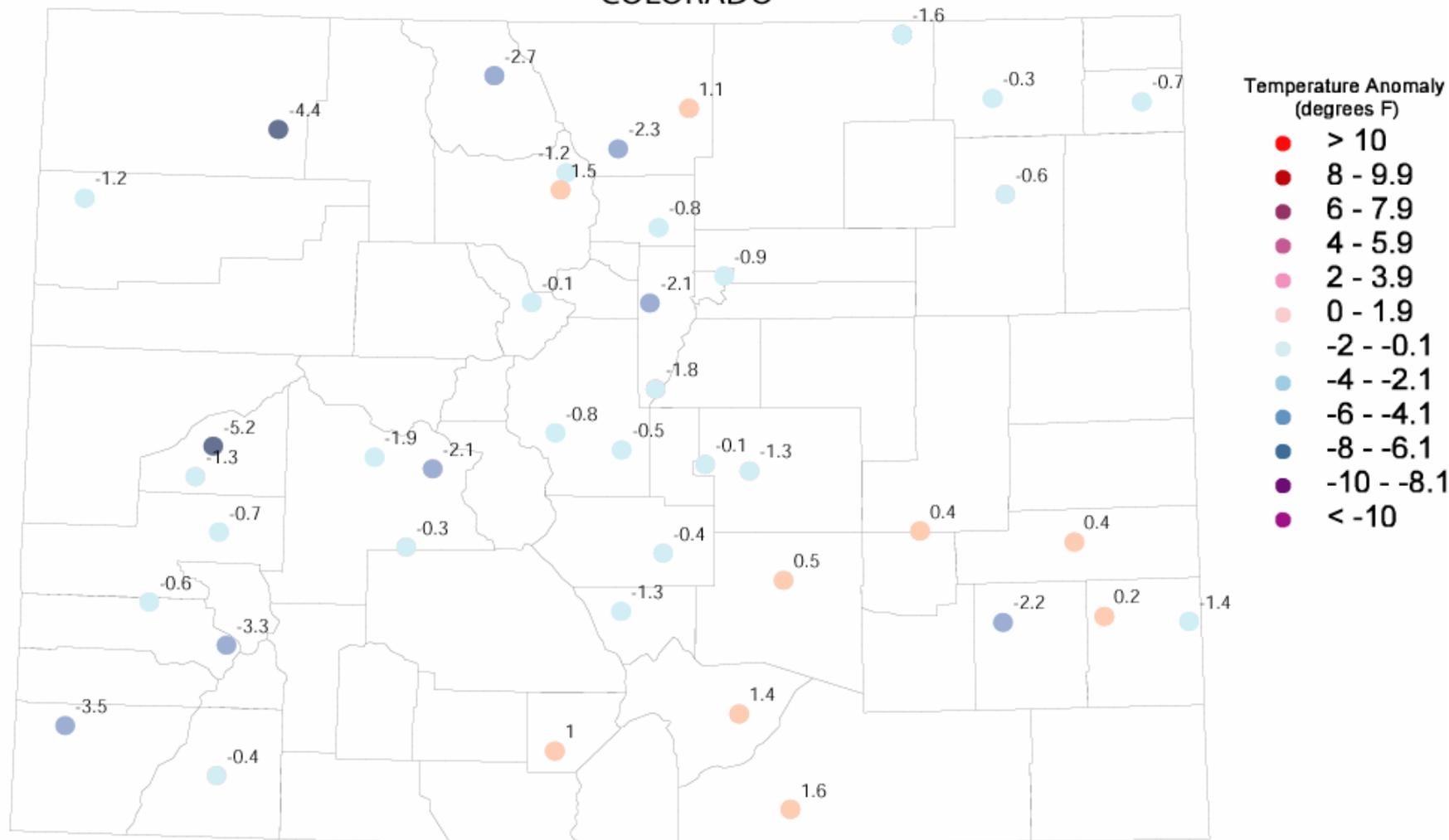


Division 8 – Fort Collins

Fort Collins 2005 Water Year

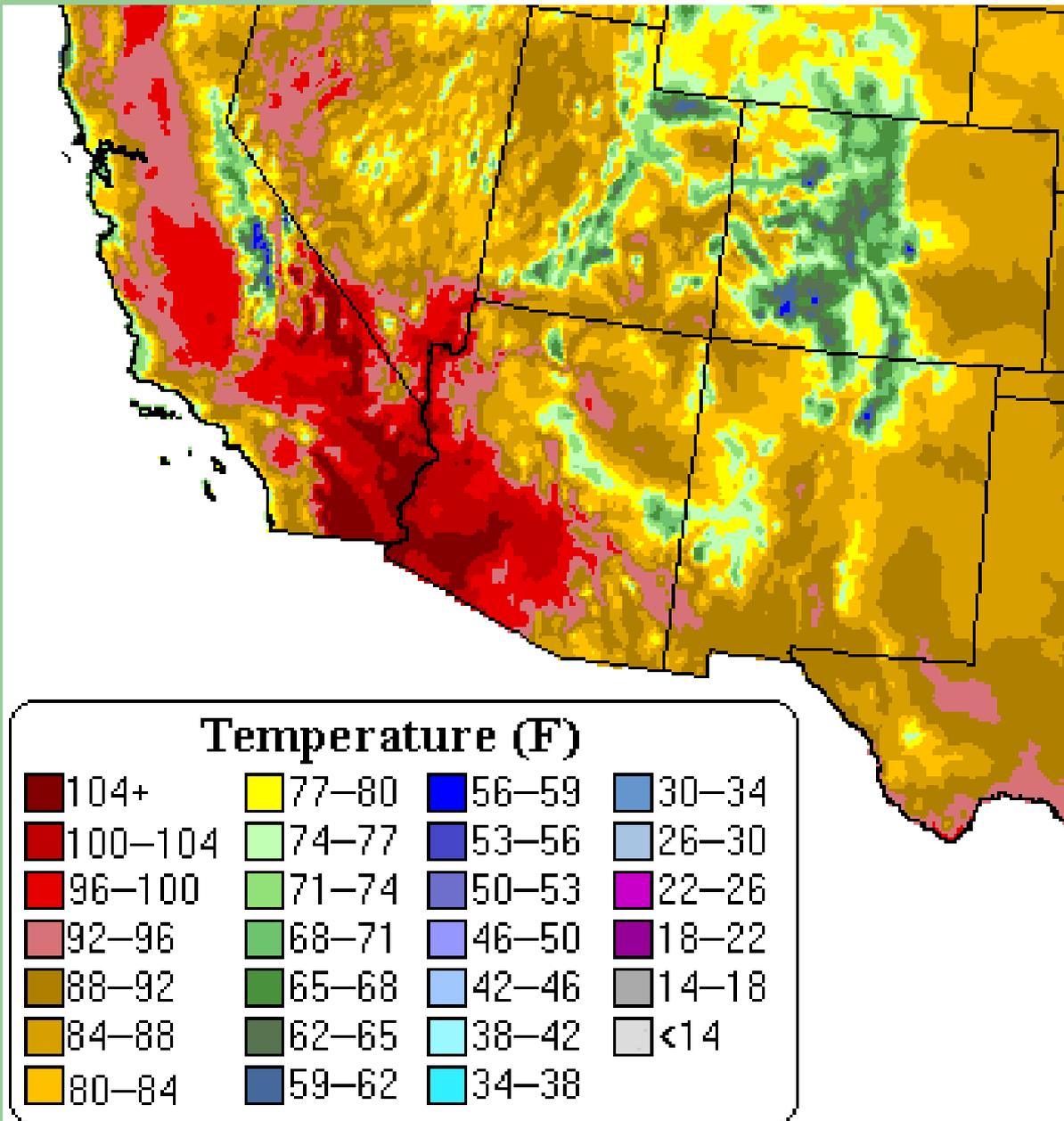


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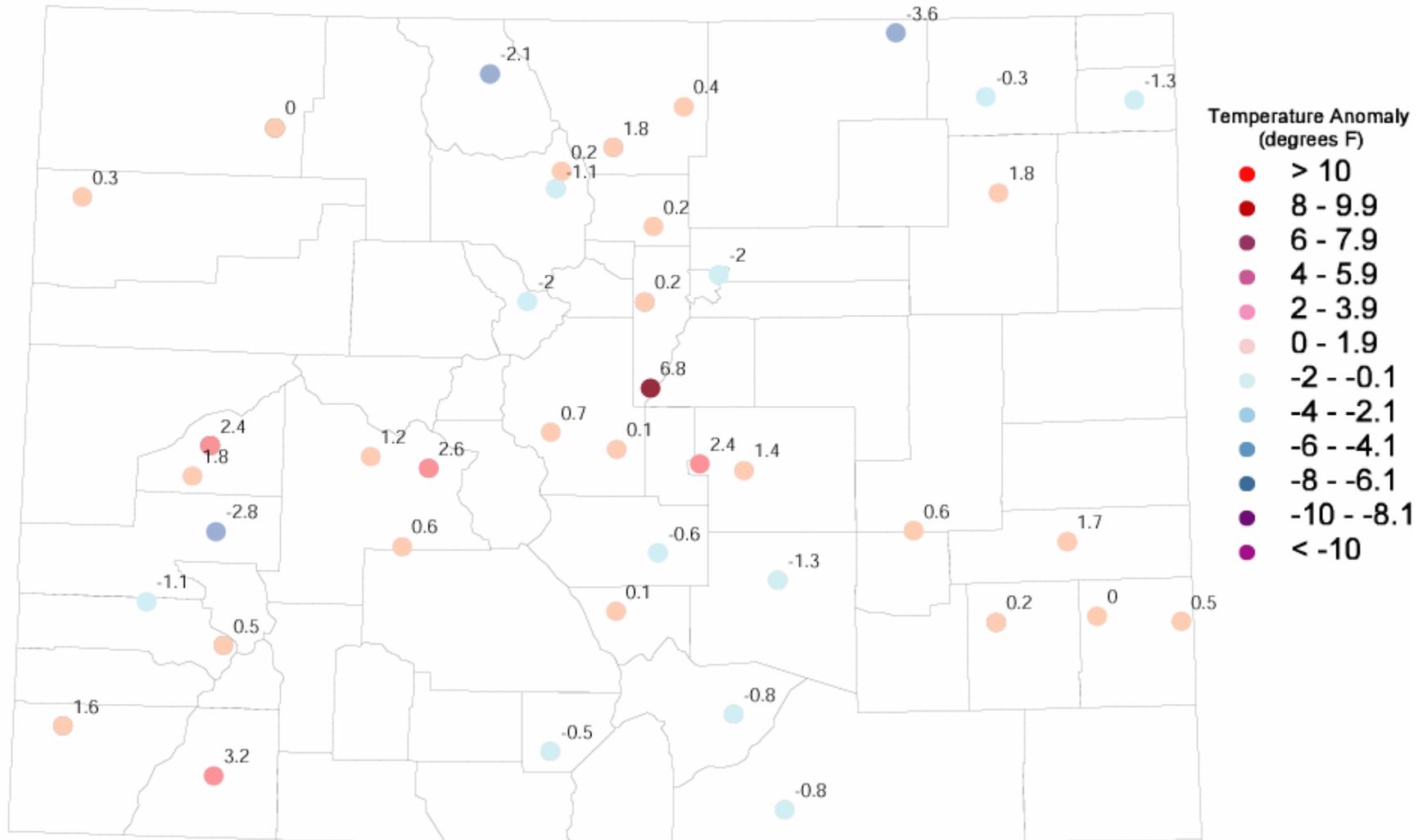


August 2005 average maximum temperature departures from the 1971-2000 averages.

August 2005
Maximum
Temperature

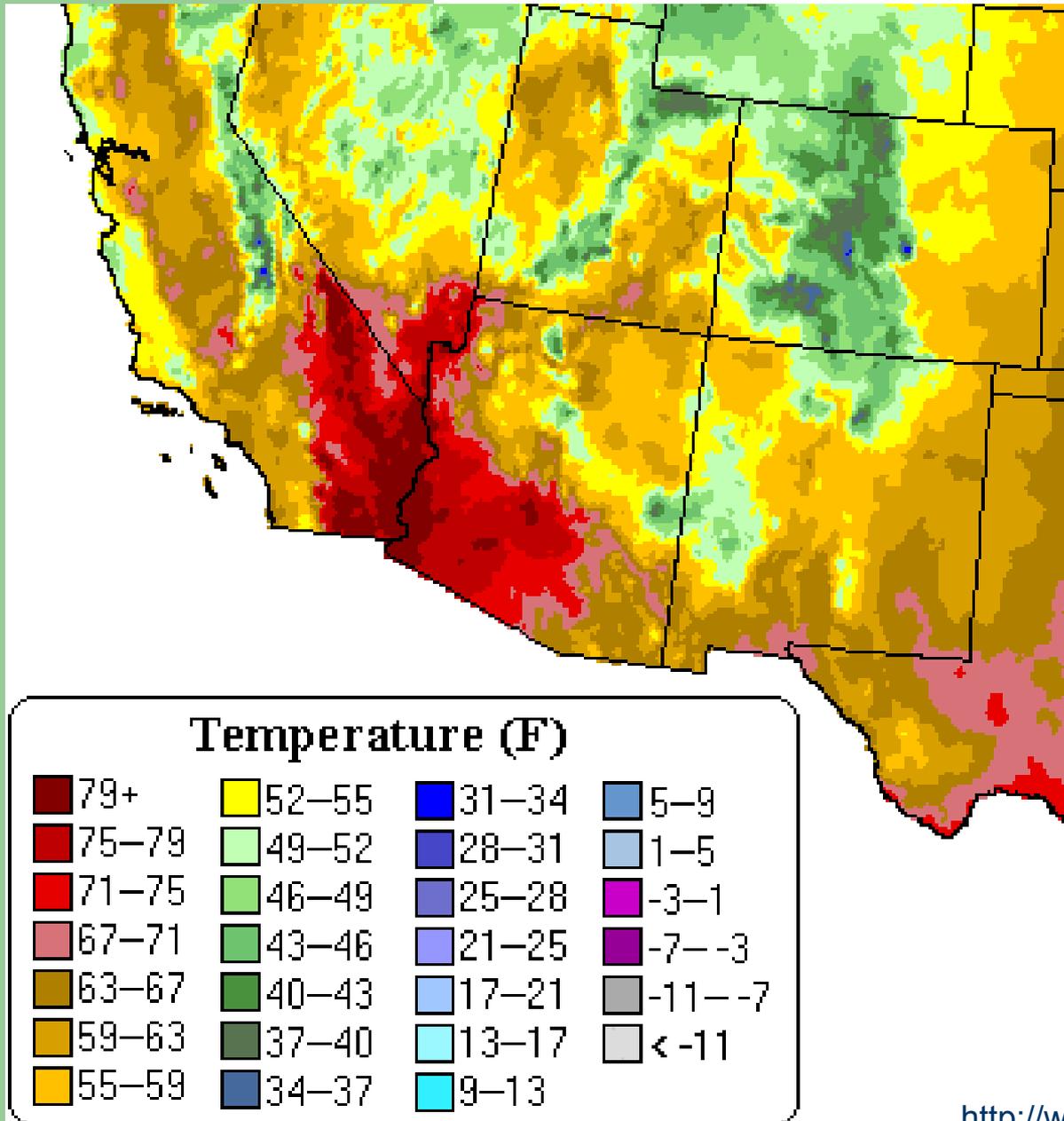


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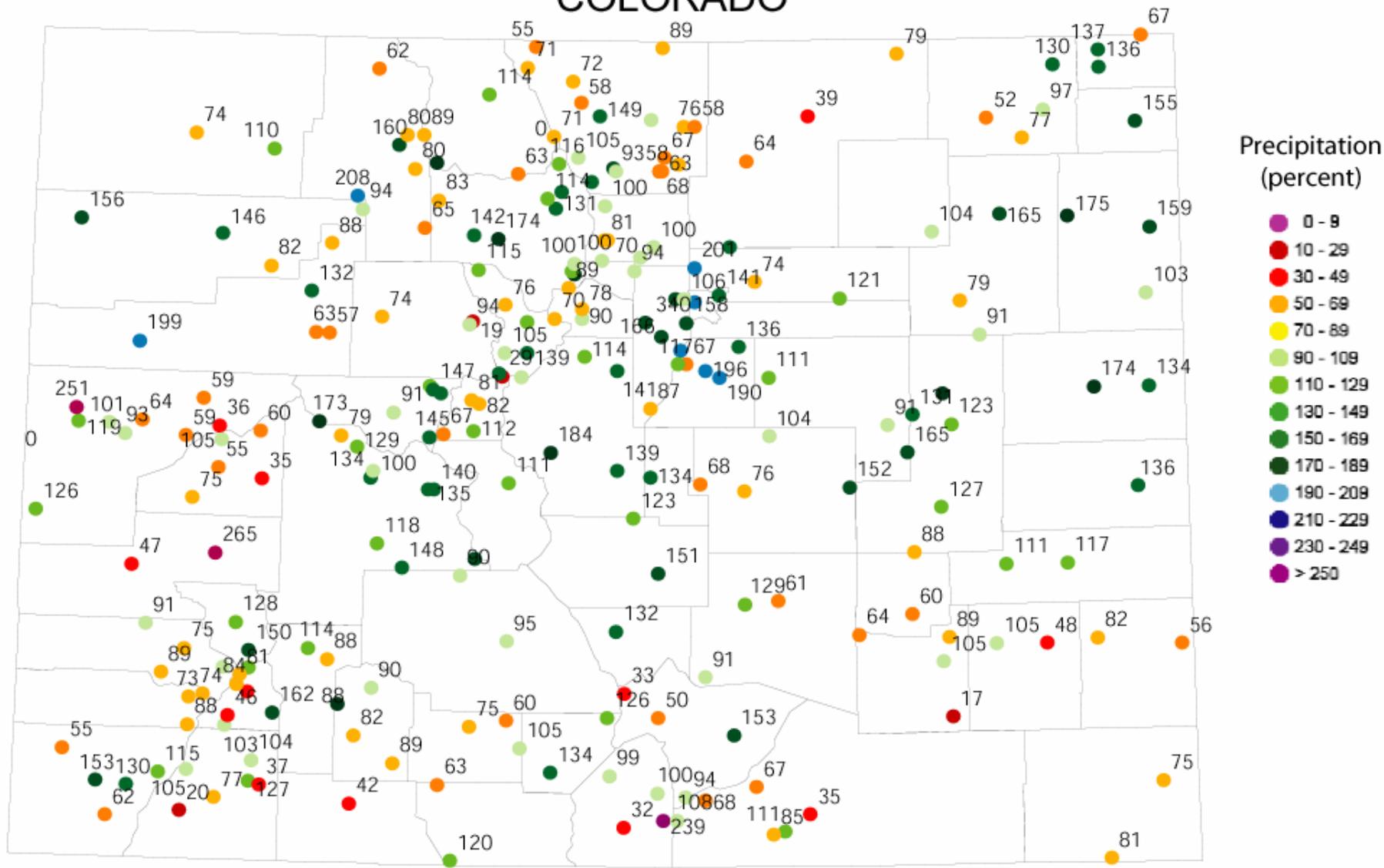


August 2005 average minimum temperature departures from the 1971-2000 averages.

August 2005
Minimum
Temperature

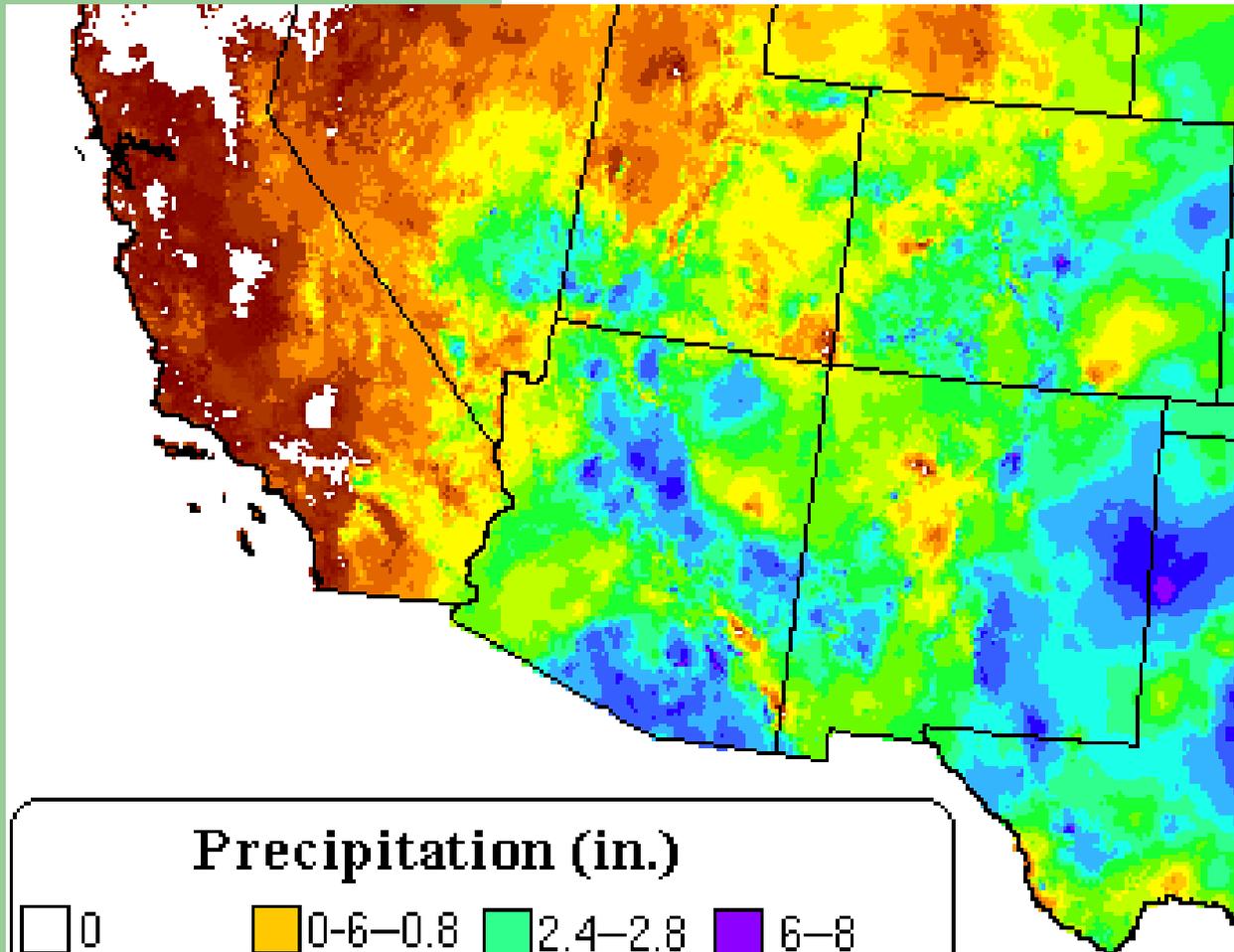


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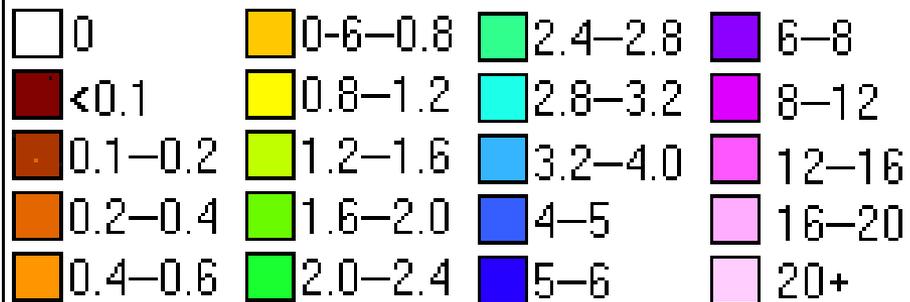


August 2005 precipitation as a percent of the 1971-2000 average.

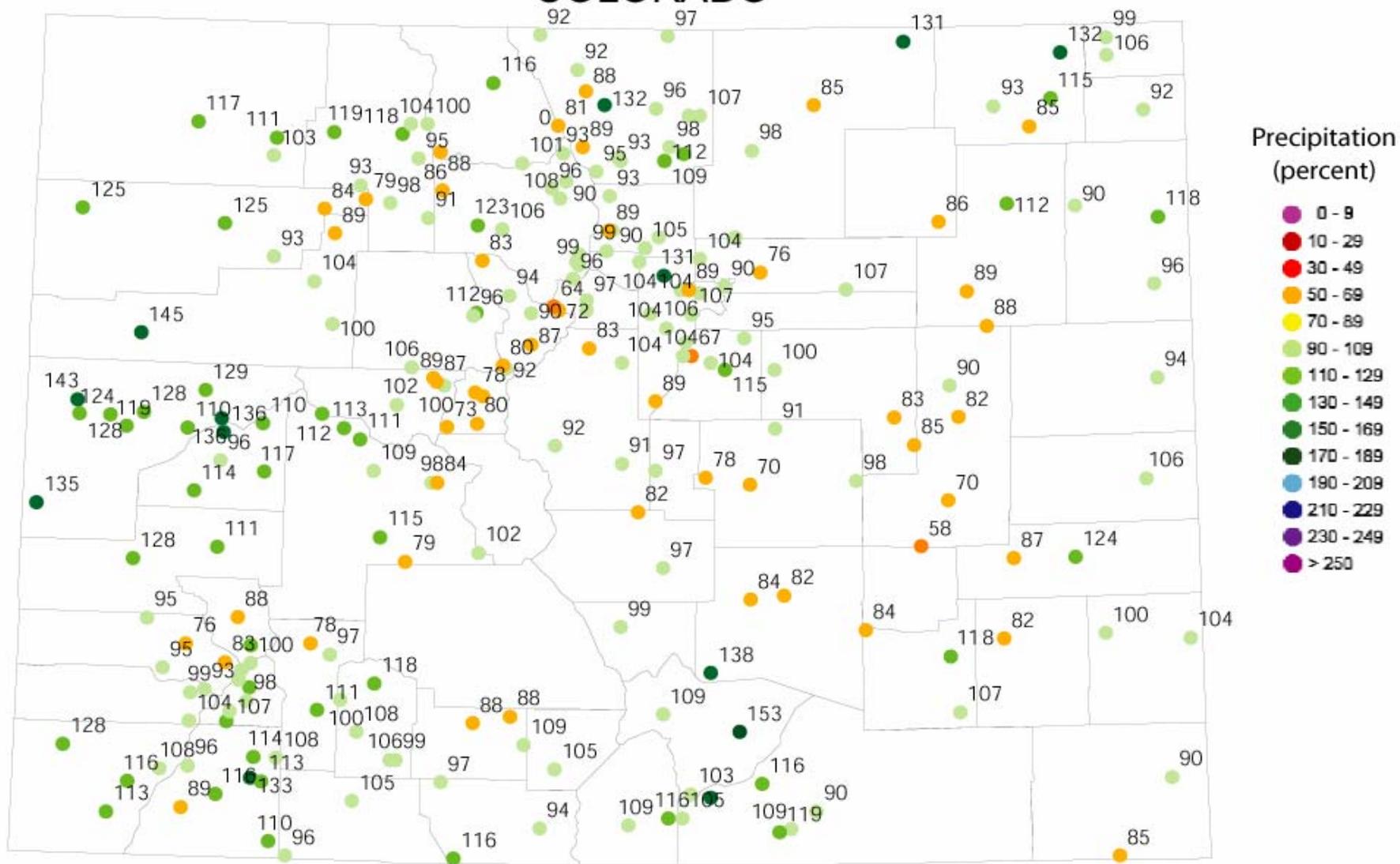
August 2005 Precipitation



Precipitation (in.)



COLORADO

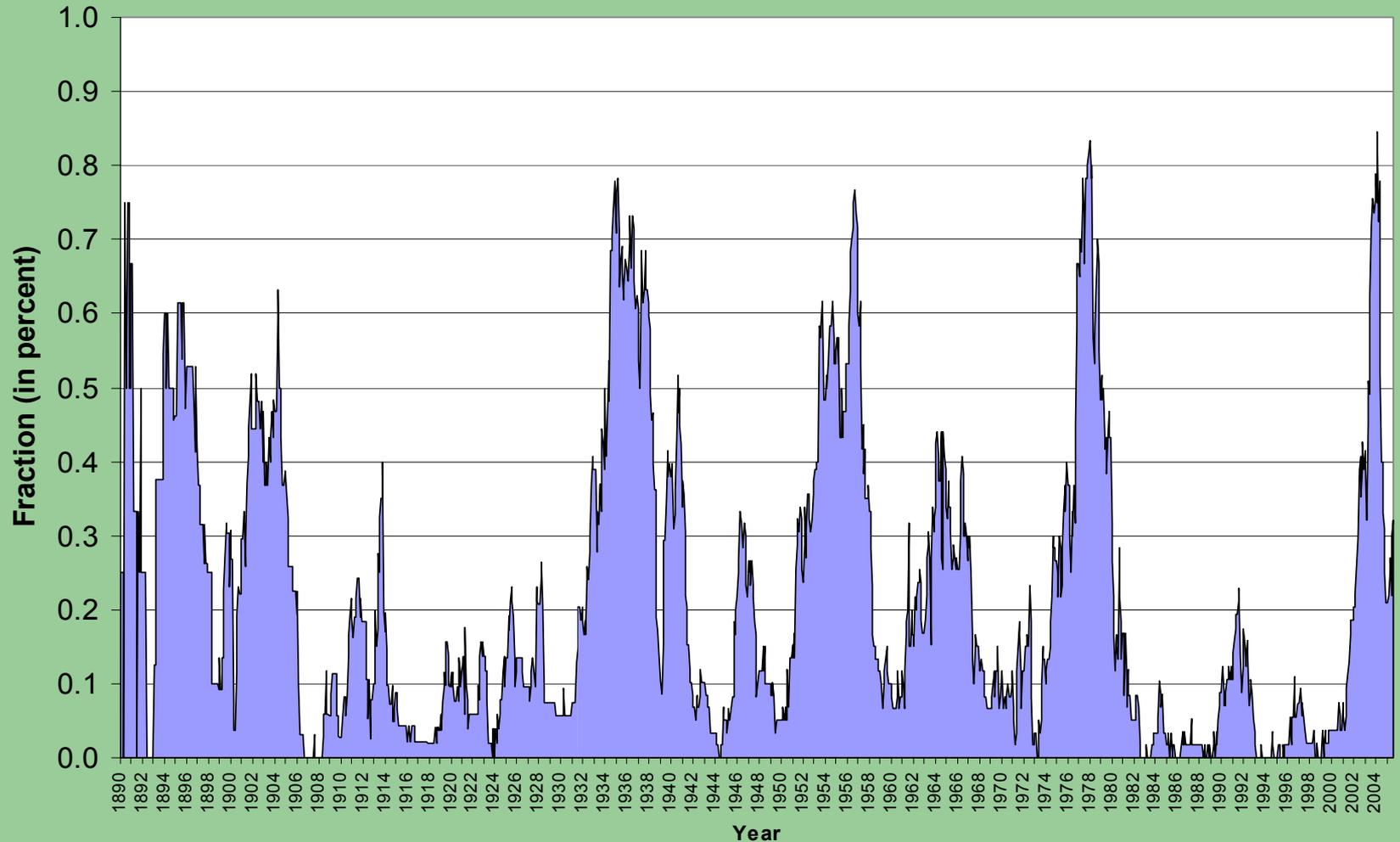


Water Year 2005 (October 2004 through August 2005) precipitation as a percent of the 1971-2000 average.

Fraction of Colorado in Drought

Based on 48 month SPI

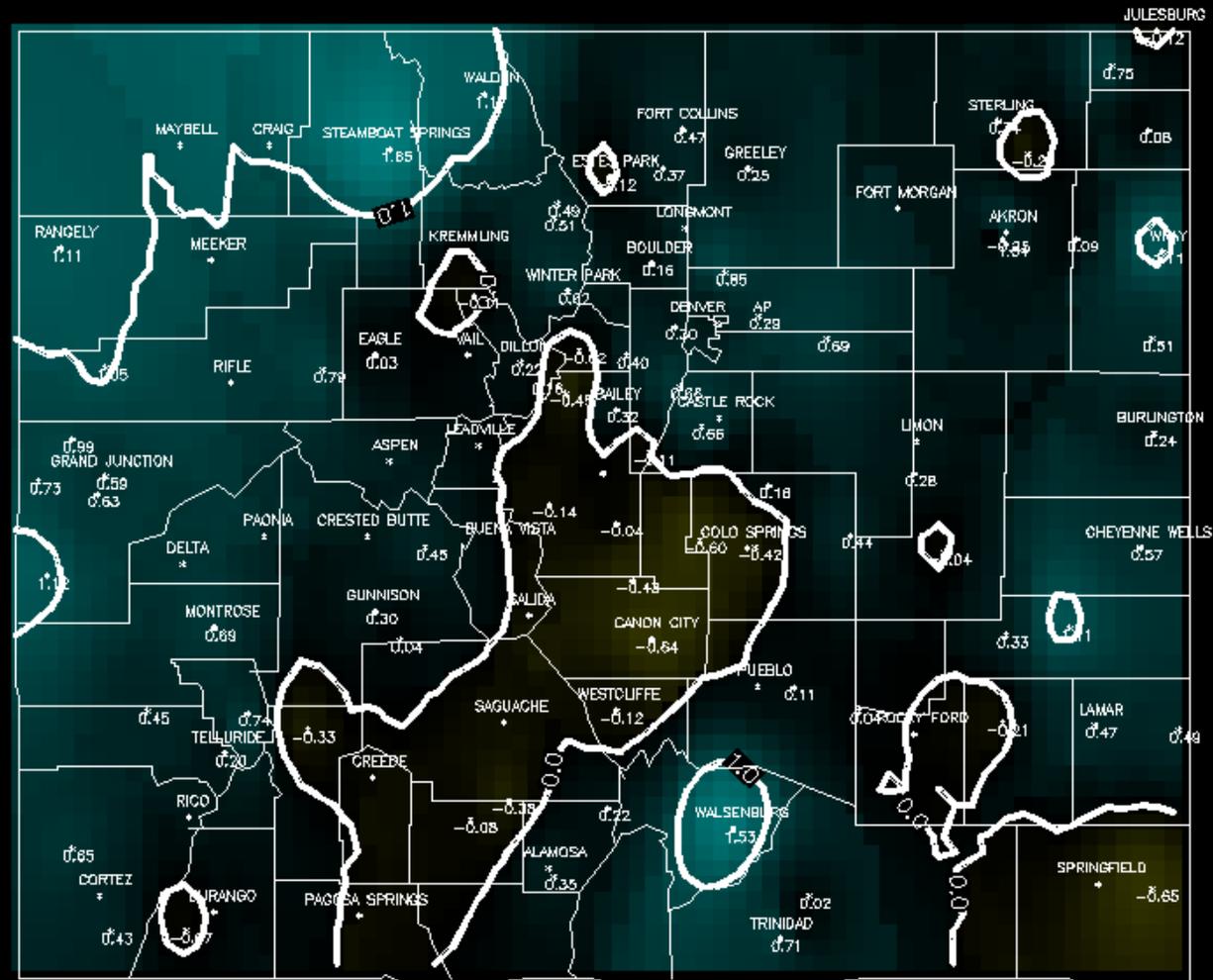
(1890 - August 2005)



Projected Conditions at 0.8 Probability Level 12 Month SPI at 6 months

Colorado

8/2005 12 mon. SPI – Projected 6 mon. at P=0.80

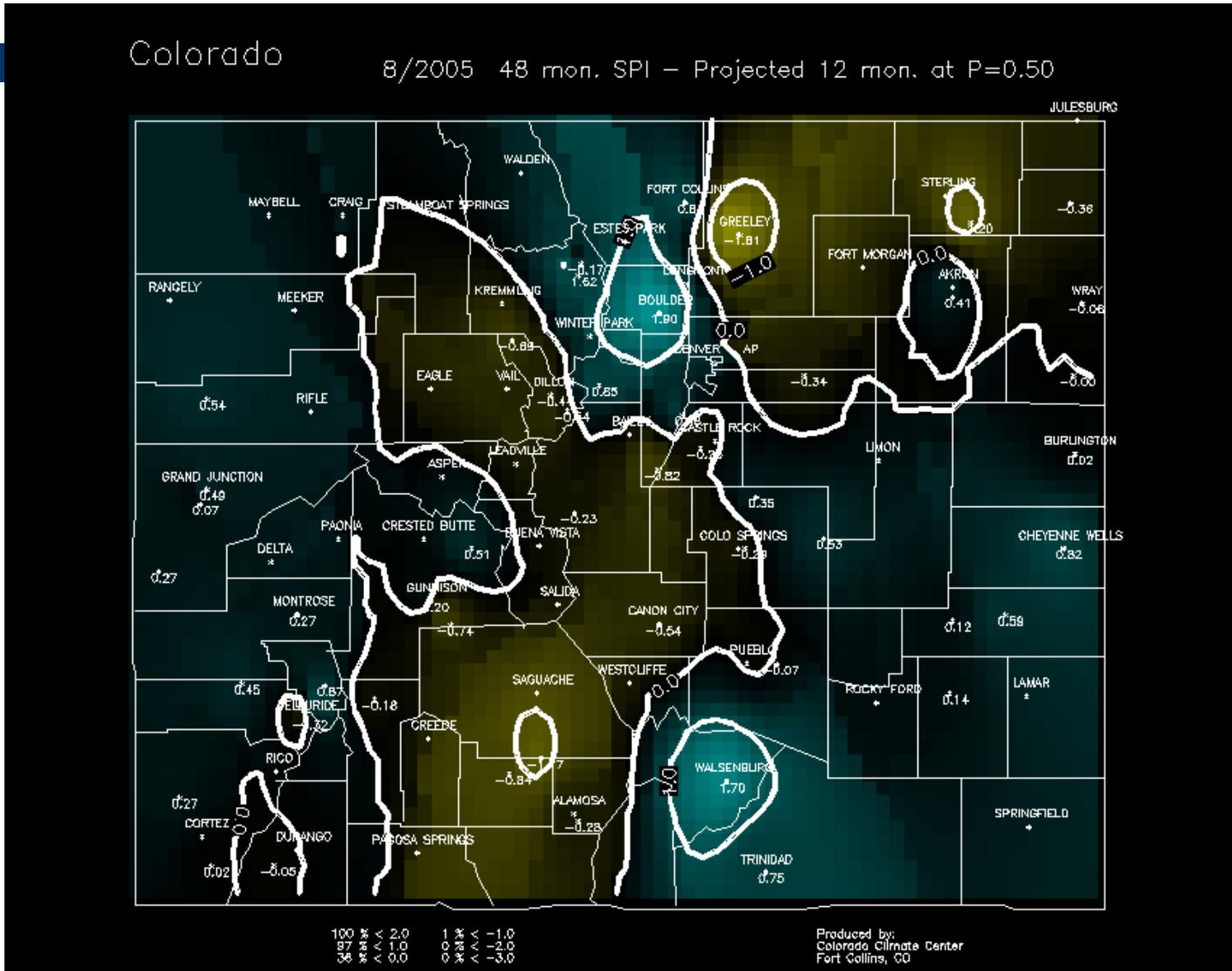


100% > 2.0
89% > 1.0
16% > 0.0

0% < -1.0
0% < -2.0
0% < -3.0

Produced by:
Colorado Climate Center
Fort Collins, CO

Projected Conditions at 0.5 Probability Level 48 Month SPI at 12 months

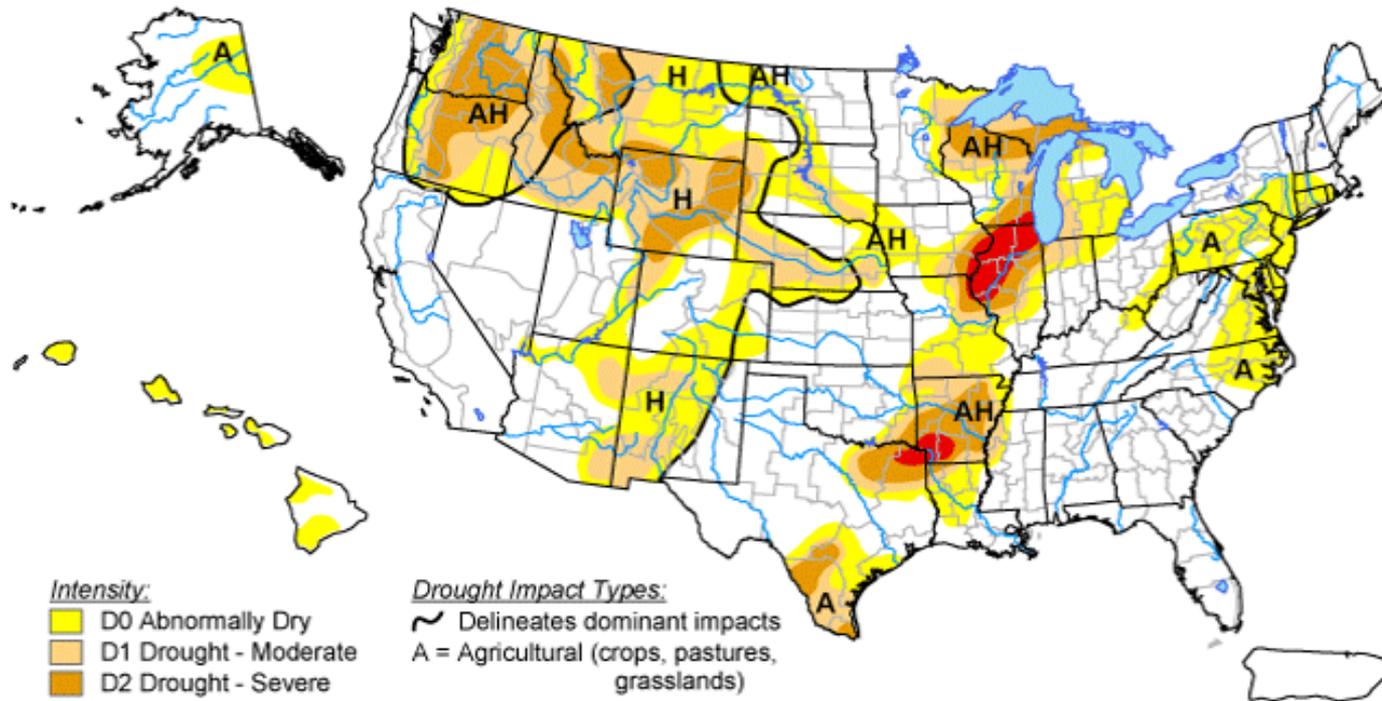


Drought Monitor Map

U.S. Drought Monitor

September 6, 2005

Valid 8 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)
- (No type = Both impacts)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

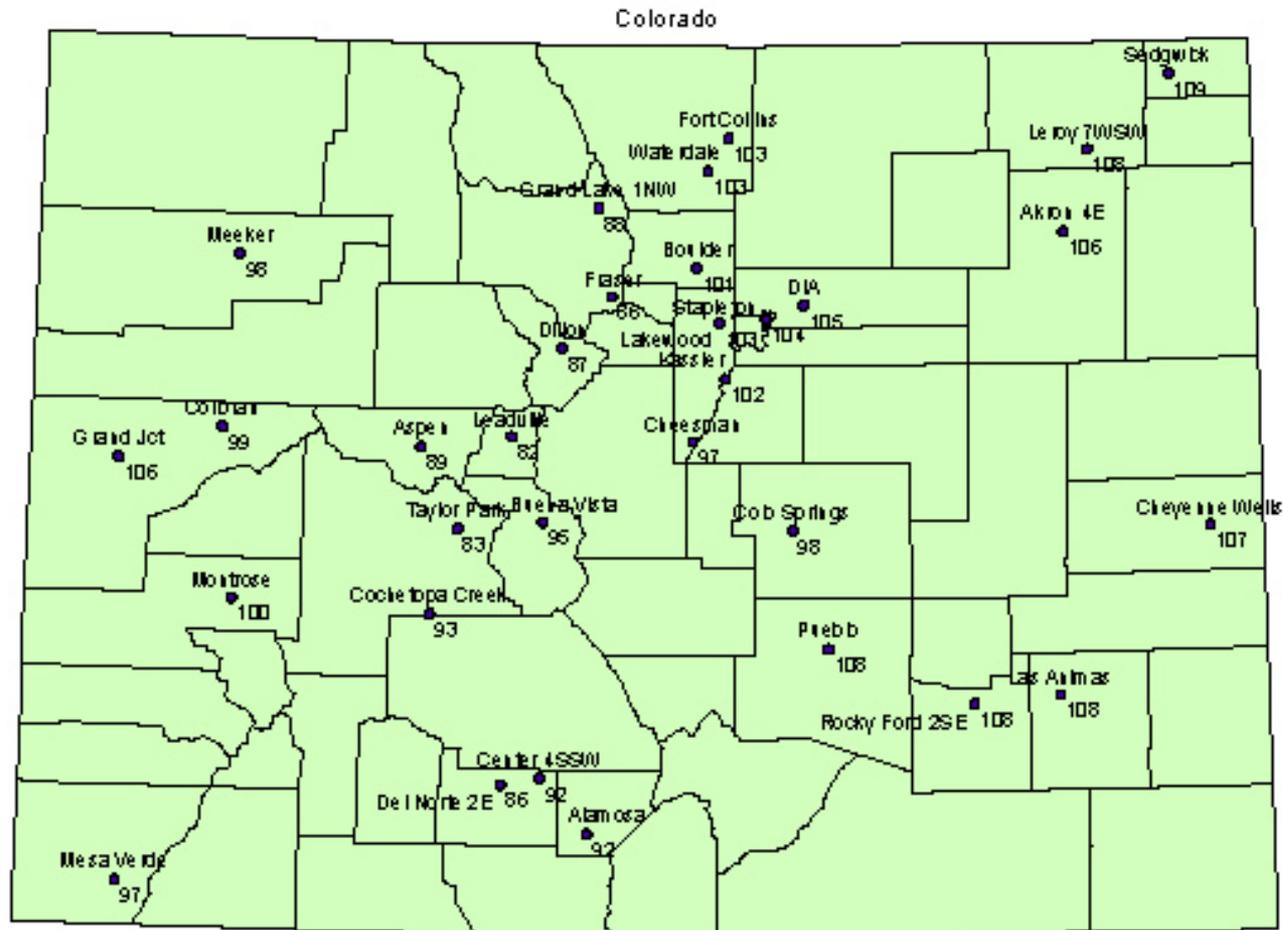


Released Thursday, September 8, 2005

Author: Mark Svoboda, NDMC

<http://drought.unl.edu/dm>

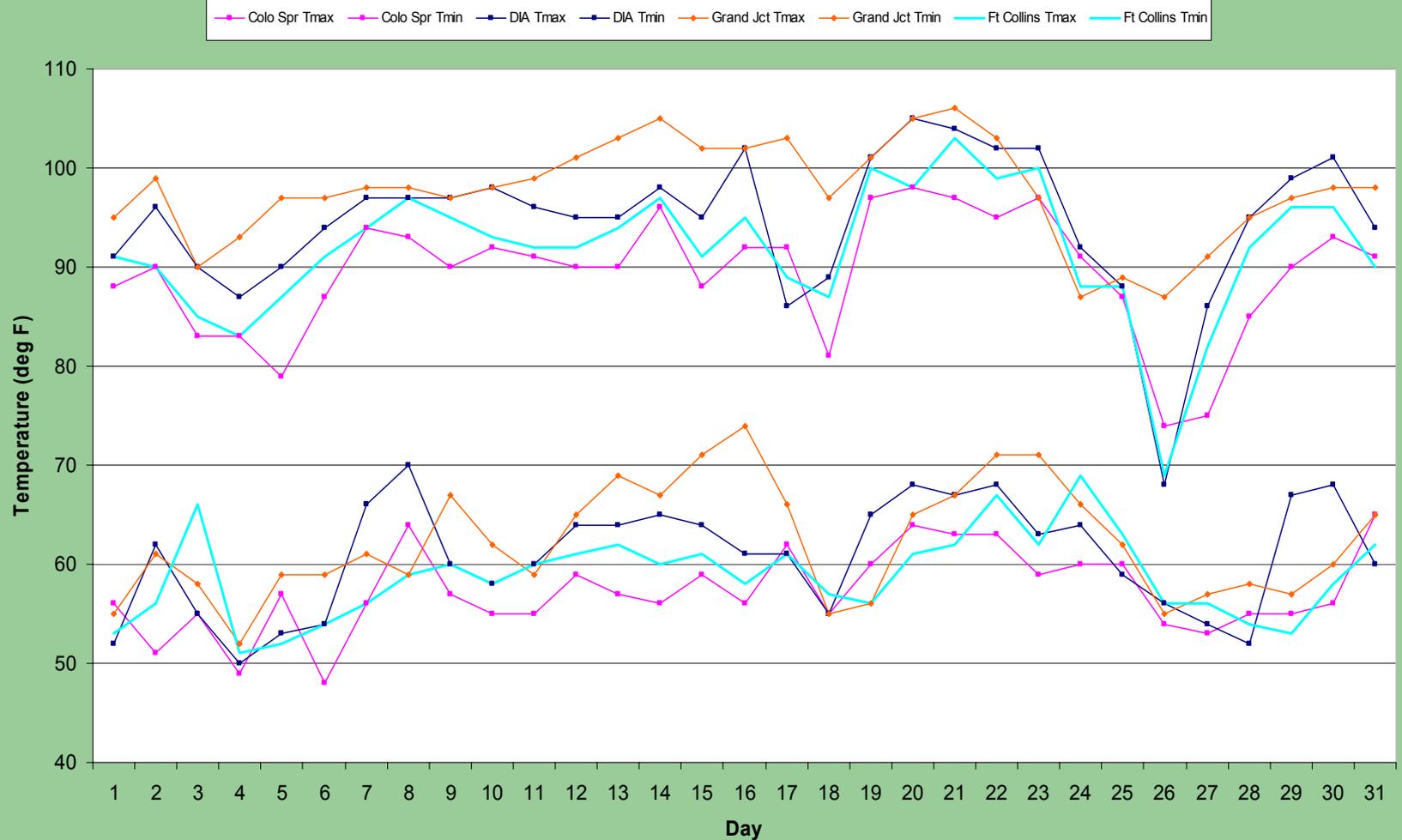
July 2005 Heat Wave



Highest maximum temperature recorded in Colorado in July 2005 for selected stations.

Colorado Springs, DIA, Grand Junction and Fort Collins daily maximum and minimum temperatures for July 2005.

July 2005 Daily Maximum and Minimum Temperatures for Selected Stations



Denver Intl AP July 2005 Records

July 2005	New Record	Old Record	Year Last Occurred
16th	102	101	2003
19th	101	100	1934
20th	105	102	1939
21st	104	100	1981
22nd	102	100	1931
23rd	102	101	1910

Data Source: NWS F-6 form

Table 1. Average maximum, minimum and mean temperatures for July 2005 and their rank for the period-of-record.

Climatic Stations	Elevation (feet)	Type of Station	Period of Record (POR)	July 2005 Temperature		
				Max (Rank)	Min (Rank)	Mean (Rank)
Akron 4E	4550	Coop	1905-2005	93.3(5+)	61.0(2)	77.2(2)
Alamosa	7533	ASOS	1948-2005	86.9(1)	45.7(47)	66.3(8)
Aspen / 1SW (combined)	7936/8163	Coop	1914-2005	81.1(16)	48.7(5)	64.9(6)
Boulder	5484	Coop	1893-2005	91.6(4)	58.5(53)	75.1(21)
Buena Vista	7946	Coop	1905-2005	87.2(5)	50.8(2)	69.0(3+)
Center 4 SSW	7673	Coop	1942-2005	84.1(7)	46.5(28)	65.3(5)
Cheesman	6880	Coop	1902-2005	87.7(9)	52.5(11)	70.1(4)
Cheyenne Wells	4250	Coop	1897-2005	93.1 (26+)	59.4(54+)	76(34+)
Cochetopa Creek	8000	Coop	1947-2005	86.1(3)	41.4(33+)	63.8(6+)
Collbran / 2SW (combined)	5980/6100	Coop	1901-2005	92.0(8)	52.3(40)	72.1(14+)
Colorado Springs WSO	6181	ASOS	1948-2005	89.3(5)	57.2(26)	73.3(9)
Del Norte 2E	7864	Coop	1920-2005	79.6(32)	45.8(77)	62.7(52)
Denver Intl Airport	5414	ASOS	1995-2005	94.5(1)	60.8(4)	77.7(1)
Denver Stapleton	5286	Coop	1948-2005	92.6 (3)	60.1(13)	76.4(6+)
Denver (combined)	5325/5286	Coop	1921-2005	92.6(3)	60.1(39)	76.4(10+)
Dillon	9065	Coop	1910-2005	78.2(6)	37.4(42+)	57.8(11)

Table 1 continued

Fort Collins	5001	Coop	1895-2005	91.7(2+)	58.8(10+)	75.4(3)
Fraser (combined)	8560/8563	Coop	1910-2005	78.7(3)	35.8(27+)	57.3(8)
Grand Junction WSO	4858	ASOS	1900-2005	97.7(3+)	62.2(93+)	80.0(21)
Grand Lake 1NW	8720	Coop	1940-2005	80.9 (5)	39.8(16)	60.2(6)
Kassler	5587	Coop	1918-2005	91.9(2)	61.3(12+)	76.6(5)
Lakewood	5640	Coop	1962-2005	93.5(1)	60.0(7)	76.8(2)
Lakewood/Edgewater (combined)	5640/5453	Coop	1902-2005	93.5(5)	60.0(11)	76.8(5+)
Las Animas	3890	Coop	1893-2005	97.5(24+)	62.8(23)	80.1(22)
Leadville	9938	Coop	1976-2005	74.6(6)	39.4(4+)	57.0(15+)
Leadville (combined)	9941/9938	Coop	1949-1982	74.6(6)	39.4(24+)	57.0(14+)
Leroy 7WSW	4470	Coop	1893-2005	93.5(7)	60.3(14+)	77.0(8)
Meeker	6180	Coop	1894-2005	89.3(10)	48.1(22)	68.7(12+)
Mesa Verde NP	7115	Coop	1923-2005	88.5(23+)	59.0(15)	73.8(17)
Montrose No. 2	5785	Coop	1896-2005	92.7(5+)	54.1(80+)	73.4(32+)
Pueblo WSO	4720	ASOS	1954-2005	97.7(2)	58.9(37+)	78.3(12)
Rocky Ford 2SE	4170	Coop	1892-2005	98.7(1)	54.2(111)	76.5(44)
Sedgwick	3990	Coop	1959-2005	94.7(4)	60.9(14)	77.8(8+)
Taylor Park	9206	Coop	1941-2005	74.7(4+)	41.7(17+)	58.2(7+)
Waterdale (near Loveland)	5230	Coop	1902-2005	91.6(6)	57.0(9)	74.3(6)

(+ means that temperature tied previous years)

Table 2. Number of Days that the July 2005 maximum temperature was greater than or equal to 90°F and 100°F and their rank for the period-of-record.

Climatic Stations	Number of Days	
	.GE. 90 (Rank)	.GE. 100F (Rank)
Akron 4E	21(12+)	6(4+)
Alamosa	9(2+)	0
Aspen / 1SW (combined)	0	0
Boulder	22(6+)	1(7)
Buena Vista	11(5)	0
Center 4 SSW	3(4)	0
Cheesman	12(10)	0
Cheyenne Wells	22	5
Cochetopa Creek	6(3+)	0
Collbran / 2SW (combined)	23(8+)	0
Colorado Springs WSO	20(2+)	0
Del Norte 2E	0	0
Denver Intl Airport	25(2)	7(1)
Denver Stapleton	22(6+)	5(1+)
Denver (combined)	22(7+)	5(1+)
Dillon	0	0

Fort Collins	22(2+)	3(2)
Fraser (combined)	0	0
Grand Junction WSO	28(12+)	10(5+)
Grand Lake 1NW	0	0
Kassler	20(5+)	3(3+)
Lakewood	22(2)	6(1)
Lakewood/Edgewater (combined)	22(7+)	6(3+)
Las Animas	27(33+)	12(26+)
Leadville	0	0
Leadville (combined)	0	0
Leroy 7WSW	22(11+)	6(6+)
Meeker	13(17+)	0
Mesa Verde NP	12(32+)	0
Montrose No. 2	23(12+)	2(4+)
Pueblo WSO	28(7+)	12(2+)
Rocky Ford 2SE	29(8+)	16(3)
Sedgwick	25(4+)	8(3+)
Taylor Park	0	0
Waterdale (near Loveland)	22(7+)	3(4+)

(+ means that temperature tied previous years)

Table 3. July 2005 highest maximum temperature, the rank for the period-of-record, the date it occurred, the highest ever July temperature and the year it occurred, and the absolute maximum temperature and the date.

Climatic Stations	Time of Obs	Record Temperature					Absolute Temperature	
		July 2005 Highest Max Temp	Jul 2005 Highest Max Temp Rank	Date of July 2005Tmax	Highest Recorded Temp	Year	Absolute Temperature	Month and Year
Akron 4E	am	106	2+	21st	107	1989	107	1989/07/09
Alamosa	mid	92	4+	17,19,20,21	96	1989	96	1989/07/05
Aspen / 1SW (combined)	am	89	12+	22nd	94	1917	94	1917/07/27
Boulder	pm	101	3+	21st	104	1954	104	1954/06/23
Buena Vista	am	95	5+	22nd	102	1927	102	1927/07/13
Center 4 SSW	mid	92	4+	20th	94	1954	95	1954/06/21
Cheesman	am	97	6+	22nd	99	1936, 1939	99	1936/07/23;
Cheyenne Wells	pm	107	3	20th	109	1936	109	1936/07/24
Cochetopa Creek	am	93	3+	23rd	94	2002, 2003	94	2003/07/19
Collbran / 2SW (combined)	am	99	2+	21st	100	2003	100	2003/07/14
Colorado Springs WSO	mid	98	5	20th	100	1954, 2003	100	1954/06/23;
Del Norte 2E	am	86	32+	15/20th	91	1940, 1951	91	1940/07/24;
Denver Intl Airport	mid	105	1	20th	105	2005	105	2005/07/20
Denver Stapleton	am	104	1	21st	104	2005	104	1994/06/26;
Denver (combined)		104	1	21st	104	2005		
Dillon	am	87	2	21st	89	1939	89	1939/07/12

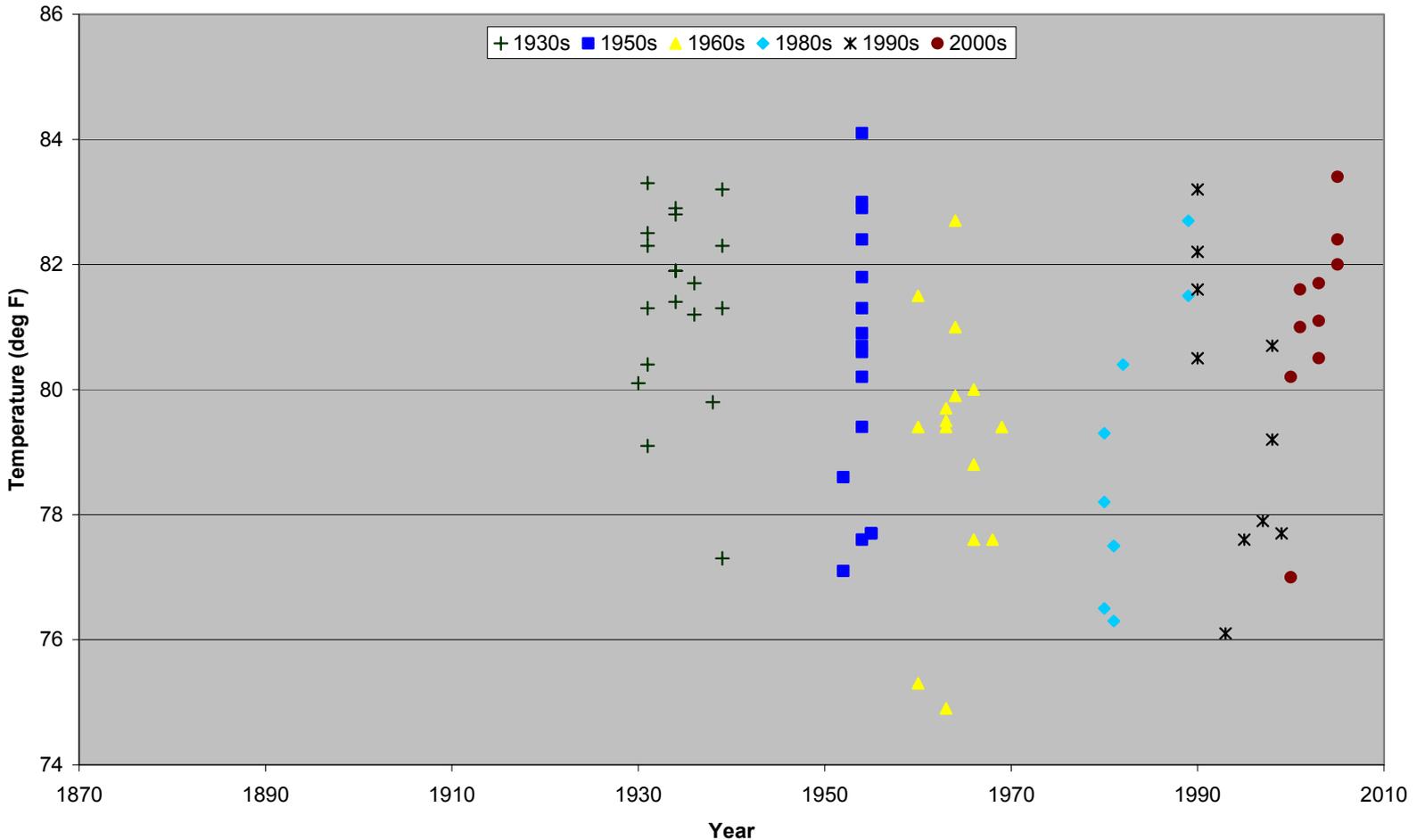
Table 3. continued

Fort Collins	pm	103	1	21st	103	2005	103	2005/07/21
Fraser (combined)	pm	86	5+	21st	94	1939	98	1969/08/01
Grand Junction WSO	mid	106	1	21st	106	2005	106	2005/07/21
Grand Lake 1NW	pm	88	7+	12th	92	1978	92	1978/07/15
Kassler	am	102	3+	21/22nd	105	2005	105	1994/06/27;
Lakewood	am	103	1	21st	103	2005	104	1994/06/27
Lakewood/Edgewater (combined)		103	4+	21st	106	1939, 1954	106	1938/08/01; 1939/07/20
Las Animas	mid	108	12+	20th	114	1933	114	1933/07/01
Leadville	pm	82	5		85	1963, 2003	86	1954/06/23
Leadville (combined)		82	8+		85	1963, 2003	85	1963/07/19
Leroy 7WSW	am	108	1+	21st	108	1990, 2005	108	1990/07/02;
Meeker	am	98	5+	22nd	103	1900	103	1900/07/11
Mesa Verde NP	am	97	12+	21st	102	1936	102	1936/07/24
Montrose No. 2	am	100	5+	21/22nd	103	1931	106	1947/08/01
Pueblo WSO	mid	108	2	20th	109	2003	109	2003/07/13
Rocky Ford 2SE	pm	108	1	20th	108	2005	108	2005/07/20
Sedgwick	am	109		20th	114	1954	114	1954/07/11
Taylor Park	pm	83	2+	21st	86	1942	86	1942/07/15
Waterdale (near Loveland)	am	103	2	22nd	104	1934	104	1934/07/13

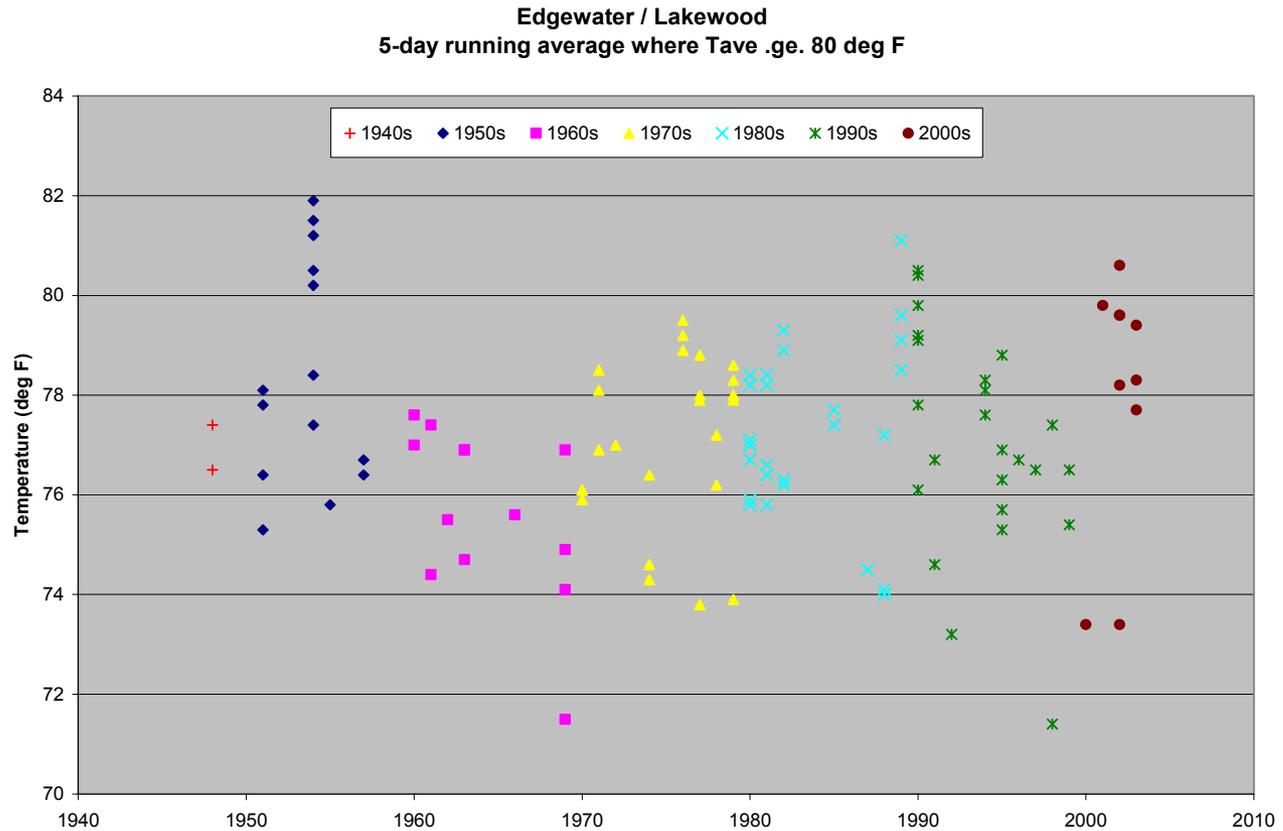
(+ means that temperature tied previous years)

Denver's 5-day running average if the average temperature was greater than or equal to 83°F or greater. Plotted by decade.

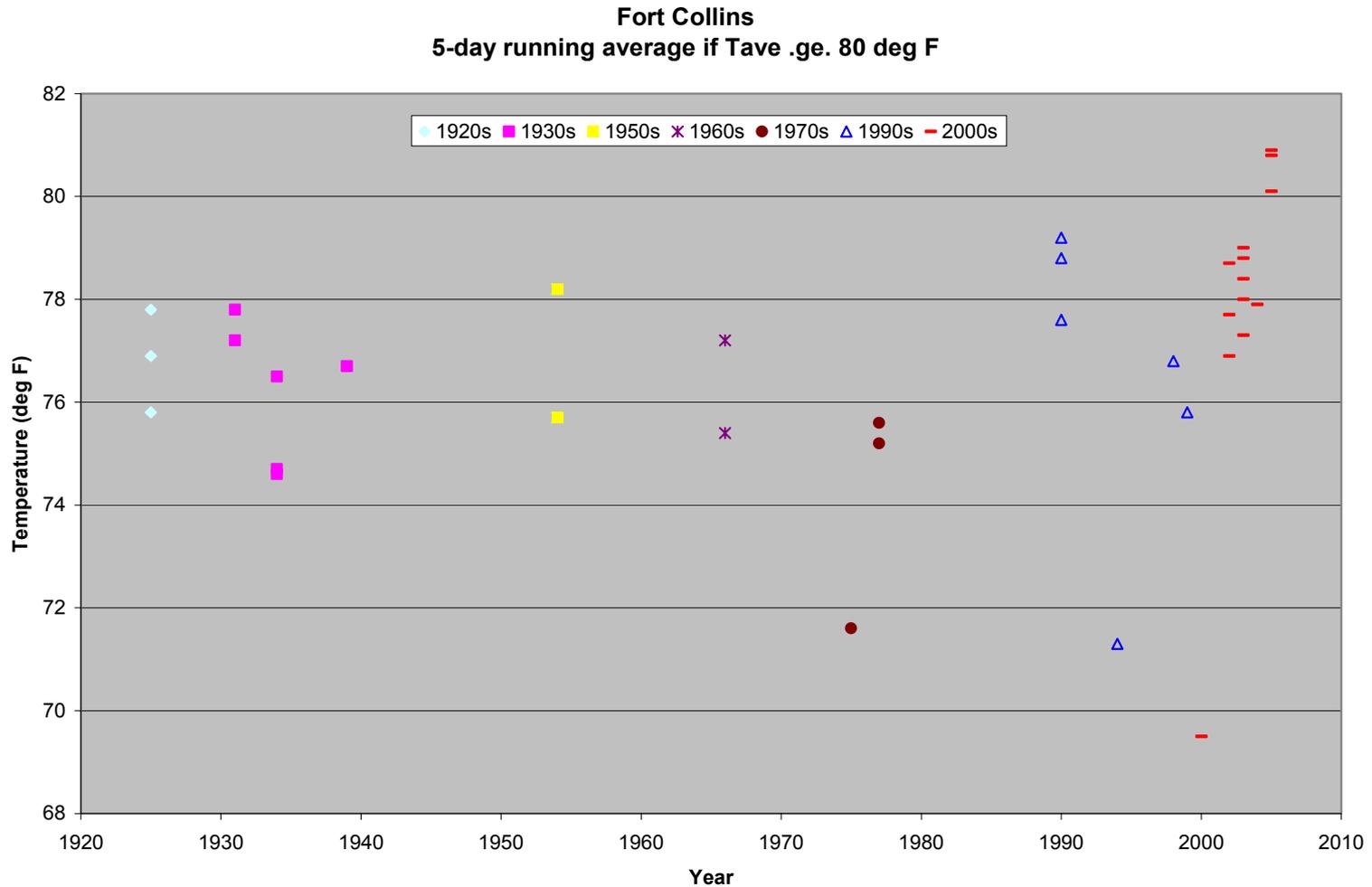
Denver Stapleton/City combined
5-day running average if Tave .ge. 83 deg F



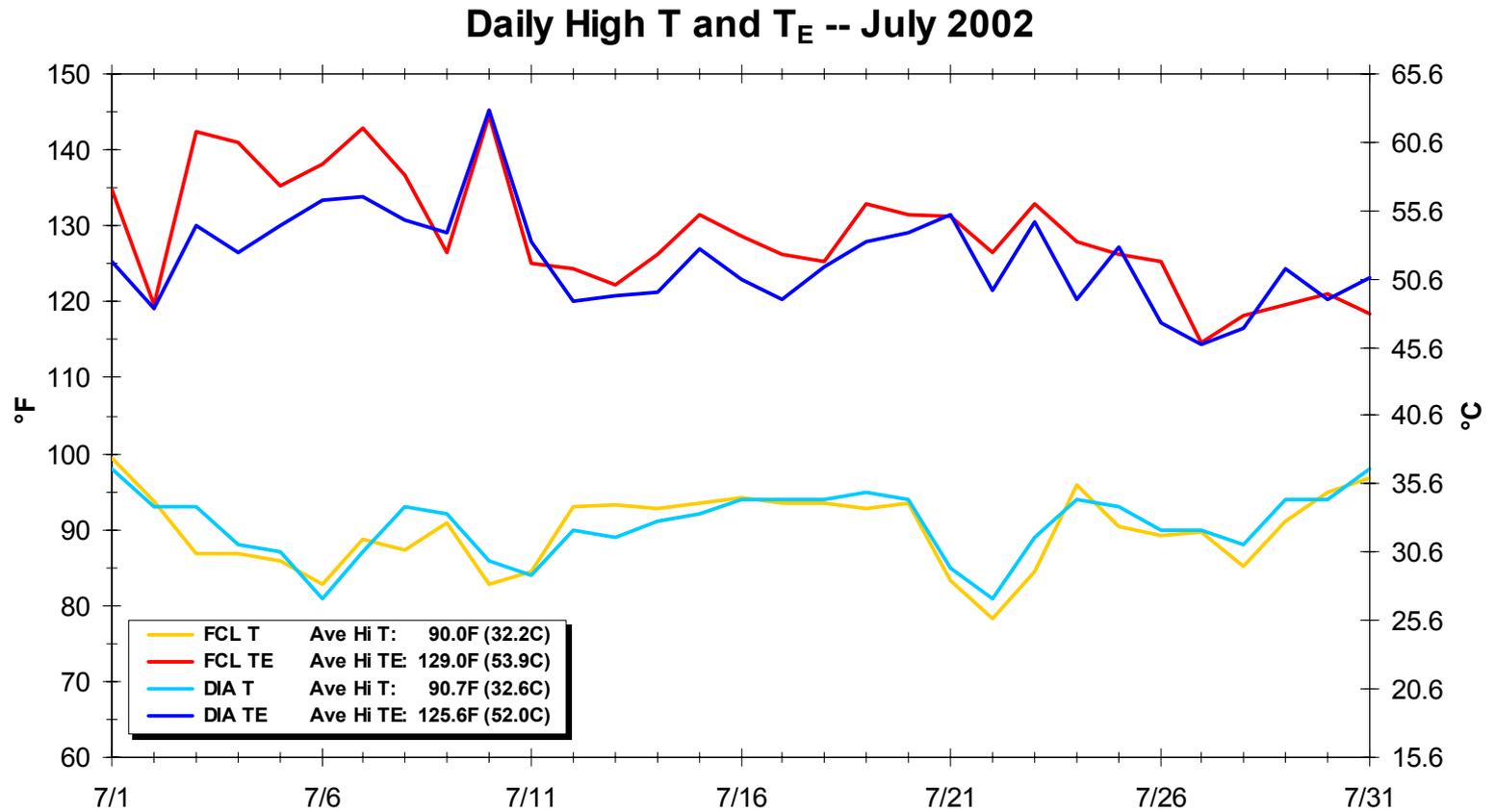
Edgewater and Lakewood 5-day running average for average temperature greater than or equal to 80 deg F.



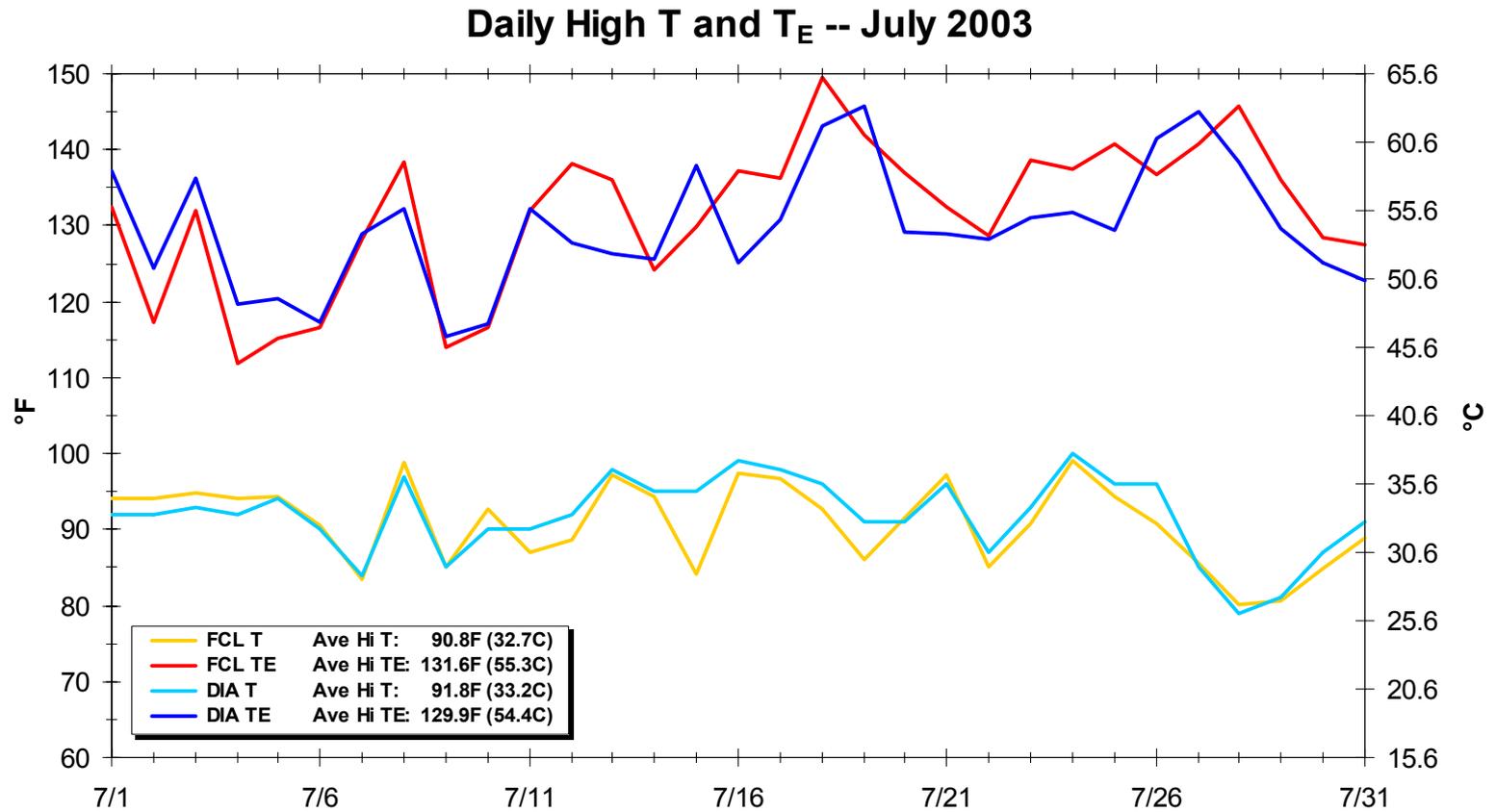
Fort Collins 5-day running average for average temperature greater than or equal to 80 deg F. The Bus Transfort construction begin in 2002 next to this station.



Hourly data from automated weather stations at FCL and DIA are used to pick and calculate the highest air temperature and effective temperature for each day in July 2002. In all three months, the average high air temperature is higher at DIA, while the average high effective temperature is higher at FCL.

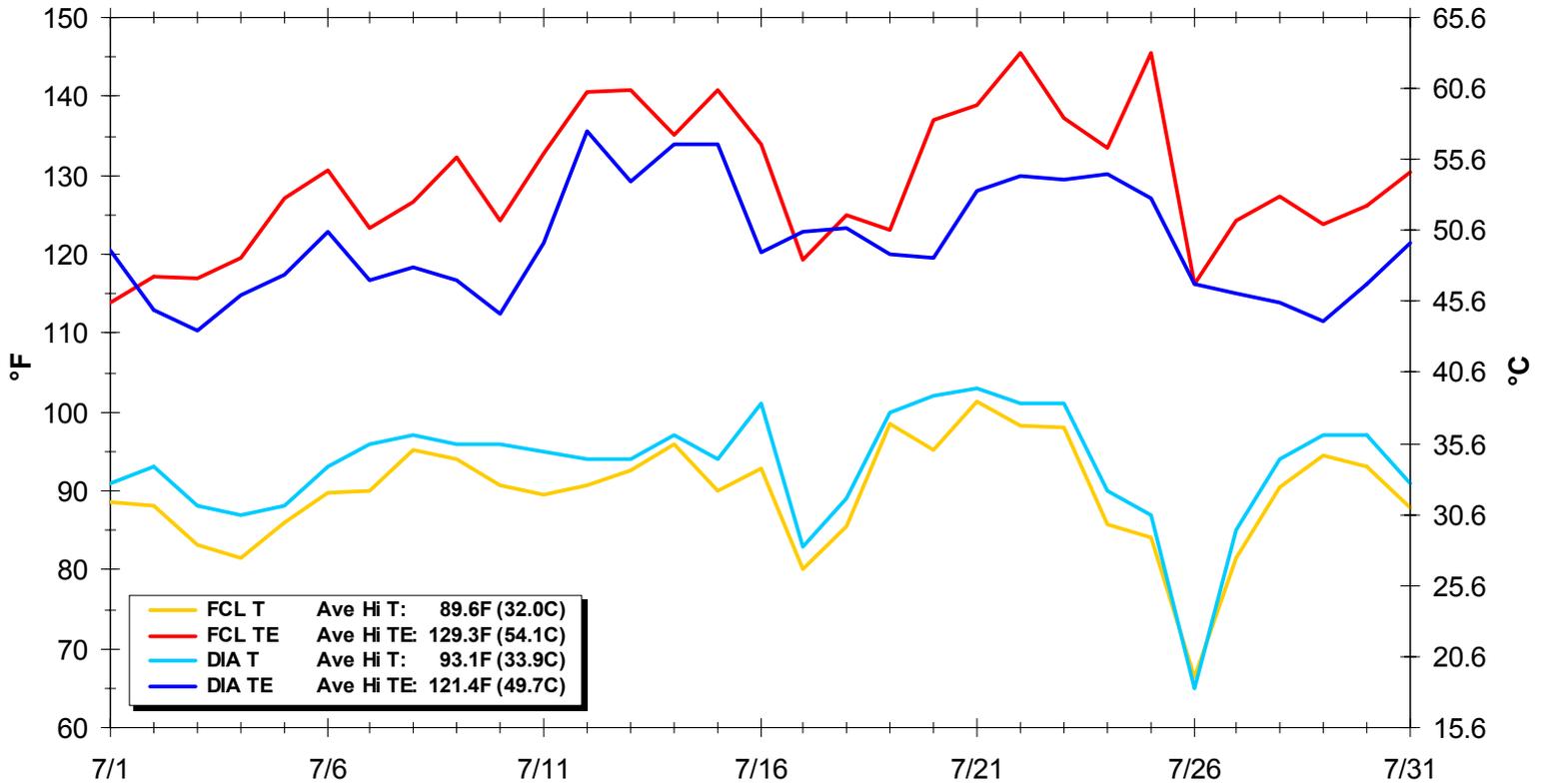


Hourly data from automated weather stations at FCL and DIA are used to pick and calculate the highest air temperature and effective temperature for each day in July 2003. In all three months, the average high air temperature is higher at DIA, while the average high effective temperature is higher at FCL.

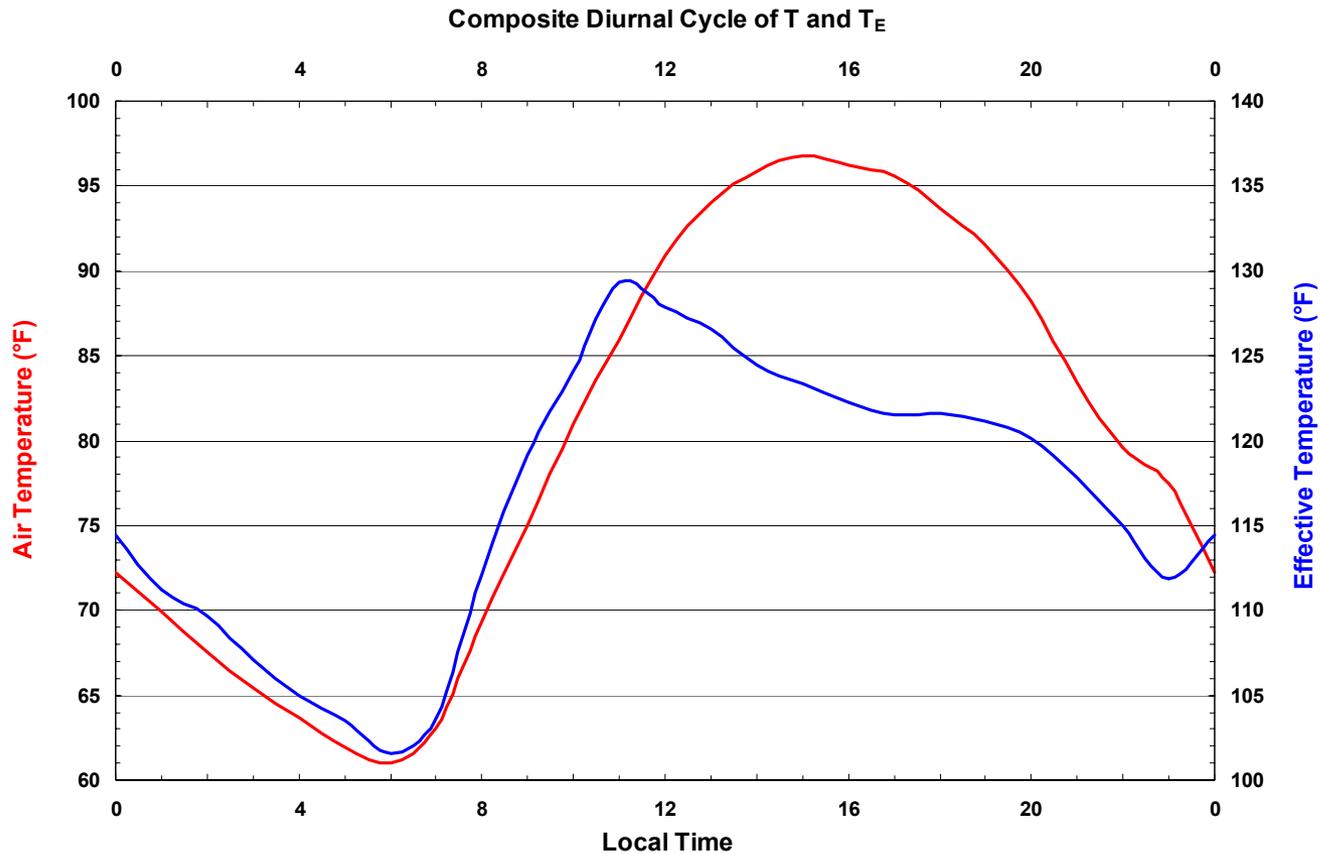


Hourly data from automated weather stations at FCL and DIA are used to pick and calculate the highest air temperature and effective temperature for each day in July 2005. In all three months, the average high air temperature is higher at DIA, while the average high effective temperature is higher at FCL.

Daily High T and T_E -- July 2005



A daily composite of air temperature (red line) and effective temperature (blue line). The composite is created by averaging hourly data during the five days with highest air temperature in each of the three years considered in this section – fifteen days total. This shows the pattern of heating and cooling on the station's extreme hottest days. Note how the effective temperature peaks approximately four hours before the air temperature peaks. Typically, the hottest days are characterized by exceptionally low relative humidity in the late afternoon, which explains the premature drop in effective temperature.



Colorado Climate Center

Colorado State University

Data and Power Point Presentations available for downloading

<http://ccc.atmos.colostate.edu>

- click on “Drought”
- then click on “Presentations”



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